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Bristol Naturalists' Society

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Besides many general indoor and outdoor meetings and excursions, others are specifically devoted to geology, plants, birds, mammals and invertebrates. Members may use the Society's large library.

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Editorial

It is one of the joys of being part of an old-established society that you are always aware of treading in the footsteps of the past. In the late nineteenth century the Society had an engineering section, which seems odd until the connection between Geology, the principle concern of the society in its early years, and the giant civil engineering projects of the time, becomes clear. One of the most distinguished members, and President of this section, was Charles Richardson, who built the Severn Tunnel, and the longest contribution in this volume describes his remarkable life and work.

The original purpose of the Society laid down by Adolph Leipner was to achieve a description of the whole of the wildlife of the region, and over the first century this was largely achieved. In more recent times attention has turned to monitoring the process of constant change which, it is now recognised, is basic to the structure of life. Henri Audcent's work on Flies published in this journal in the 1930s was a magnificent undertaking at the time, though few now recognise his name, and it provides an opportunity to measure change at least at the species level over sixty years, and John Kramer has done this in Leigh Woods for one small group of invertebrates, the *Diptera*.

We share our houses and gardens with thousands of species of wildlife, and we are only fleetingly aware of the existence of any of them. Mark Pajak's article is the first on spiders that this journal has carried in 150 years, and a vivid example of how expertise can open a window on one small fraction of this complexity.

Staying with invertebrates Robert Muston's microscopic study of *Chironomid* larvae from the Sneyd Park Nature Reserve pond is remarkable. And Ray Barnett continues to summarise the unusual records for the year. Recording and publishing records is a key part of the function of the Society.

SMITHSONIAN
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Oliver Milburn has speculated in the past in our bulletin on the evolutionary origin and significance of tails, and has followed this up with a suggestive and fascinating excursion into the physiology of bi-pedalism. The reasoning is dense, and provocative.

Sylvia Kelly charts the history of single ancient hedge. All hedges are officially protected and preserved by the city planning rules, but in practice developers hate them, and they often are left in a legal no-mans-land. Yet they are precious both in terms of the history of a city created from fields, and in sustaining wide biodiversity.

BRERC has published the latest in its series of Atlases, which began in 2000 with the Botanical Atlas. The BNS has been closely associated with all these productions, both by assisting in the process of record, and helping with the costs of production. The latest, the Dragonfly Atlas, is reviewed below. The BTO Bird Atlas of the region, the successor to that published in 1992, summarises the work of over 500 observers over four years, and charts in great detail the pattern of population change and distribution. Finally there is a review of Ian Wade's beautifully illustrated Bristol Safari. Few regions or cities can be better studied than ours.

There is a brief comment on the colour section on page 127 after the accounts.

Charles Richardson, Civil Engineer

Trevor Thompson
ROCKTHOM@btinternet.com

Born 14th August 1814

Died 10th February 1896

Past President of the Geological and Engineering Sections of The Bristol Naturalists' Society

Sir John Hawkshaw's testimonial for Charles Richardson which accompanied his recommendation that Mr Charles Richardson be admitted into the Institution of Engineers

Was apprentice to I.K.Brunel in September 1834 for four years. Had charge of sinking trial shafts for the Box Tunnel and in 1837 was for some months an assistant engineer in the Thames Tunnel. Went to Cirencester in 1838 and had charge of construction of the railway from Swindon to Cirencester as Resident Engineer. Completed this line and the shafts and headings of the Sapperton Tunnel by 1842. Completed afterwards a further section of this line down the Stroud Valley in 1846.

Had charge in that year as Resident Engineer of the Monmouth-Hereford Railway which was held in abeyance but afterwards made the Hereford, Ross and Gloucestershire Railway which was finished in 1865. Was appointed Resident Engineer of the Bristol South Wales Union Railway in 1858 After Mr I.K.Brunel's death in 1859 Mr Brereton and him were Joint Engineers of this railway. Became Chief Engineer of the Bristol Harbour Railway in 1865 and completed the first section of the line in 1870. Was appointed Engineer of of the Severn Tunnel Railway with Sir John Hawkshaw as consulting engineer in 1872.
Proposer: John Hawkshaw
18th Feb 1875

INTRODUCTION

Charles Richardson, born 14th August 1814, was not a Bristolian by birth but could almost claim to be one by adoption having spent the majority of his professional life living and working either within the city or the adjacent counties of Wiltshire, Somerset and Gloucestershire. He finally passed away at his house, No 10, Berkeley Square, Bristol on the 10th February 1896.

Since childhood we have all had the achievements of the great Victorian engineers presented to us as part of our education. Names such as Stephenson, Barlow, Brunel, immediately come to mind, but there are many others who designed and built great works but are rarely mentioned when such are the subject of TV documentary programmes. Bazalgette for sewers. Father and son George and Robert Stephenson, with Barlow for railways. The Brunels, Marc and his son Isambard Kingdom, for just about everything from the Thames Tunnel to new docks and bridges, ships and the GWR. But there are many others who fail to make the headlines and their contribution to the complete picture was in no way insignificant.

One such person was Charles Richardson who was not only a competent engineer qualified in the complexities of the design of structures, but a geologist, visionary, businessman and in his younger years an athletic man and cricketer of considerable talent. Having had a successful career for 45 years in the profession of his choice his reputation was dashed by a natural phenomenon which no one could have foreseen. As a result his achievements and entire portfolio of works are hardly mentioned and for the credit of his greatest work to be ignored by his contemporaries. He thus spent the later years of his life defending his reputation and seeking to correct the injustice that he felt had been levelled against him.

The Life and Works of Charles Richardson

Charles Richardson was born on the 14th August 1814 at Capenhurst Hall Nr. Chester into a family of not inconsiderable means. He was the third son of Mr Richard Richardson who was a J.P and Deputy Lieutenant of the County and Chairman of the Quarter Sessions. Charles was six years of age when his father died.

His primary education was gained at a private school in England and further educated at a private school on the outskirts of Paris. He then attended University of Edinburgh where he read mathematics. Throughout his early years he showed exceptional ability in mechanics and engineering.

At the age of 19 years his formal education was complete and in 1834 began his long association with Isambard Kingdom Brunel. Charles Richardson was indentured to him as an apprentice pupil. From the testament given at his enrolment in 1875 as a M.I.C.E. it is recorded that his first practical engineering experience was gained working on sinking the trial shafts of the Box Tunnel. From the same source it is stated that in 1837 he was for some months Assistant Engineer to Brunel on the 2nd phase of the excavation of the first Thames Tunnel.

The scheme was initiated by Marc Brunel, (the father of Isambard) on which work commenced in February 1825. In April 1826, following the illness of Marc Brunel's resident engineer, Isambard at the age of 20 years was appointed as his replacement. The work was suspended in 1828 and remained closed until August 1835. It is recorded that Charles Richardson demonstrated much physical strength and courage whilst working on the Thames Tunnel and also when working with Brunel on the Clifton Suspension Bridge in scrambling down St Vincent's Rocks to take Brunel's instruction to those below when the first bar was carried across the gorge.

During the months June to September 1836 he worked on the Bristol-Exeter line often accompanying Brunel on his travels, surveying, setting out and inspecting work.

Swindon-Cirencester-Gloucester Railway

From September 1836 he was increasingly involved in the Swindon - Cirencester line and in 1837 at the age of 23 years was appointed Resident Engineer for the project. and took up residence, close to the project in Flintham House, in the village of Oaksey complete with two servants and a groom.

It was an amazing expression of confidence by Brunel in the abilities of such a young man. It was a complicated project including embankments and cuttings, a tunnel at Sapperton, a viaduct and bridges. In addition the tortuous route through the Stroud Valley at Chalford was complicated geologically and crowded. It already accommodated a toll road, the Thames Severn Canal, a river and numerous cloth mills with their mill-ponds and tail-waters.

From the outset the project was bedevilled with problems arising from land slips caused by inclement weather and the poor material used to form the embankments at the Swindon end of the line. On this section the line required an embankment 30 feet high for a length of almost 2 miles. Unfortunately there was insufficient arisings from cuttings to make up the embankments. To overcome this problem additional land was purchased for side cuttings 125 feet wide by 10 feet deep either side of the line. There was an additional allowance for 12 feet of undisturbed land on both sides at the base of the embankment. The problems arose from the material arising from the excavation which was of Kimmeridge clay. In Richardson's own words *"an easily grafted material, but the most slippery stuff I have ever had to deal with"*. The combination of prolonged inclement weather during the construction, coupled with the natural characteristic of the clay and sub-strata resulted in major slippages of the embankments when the line was due to be opened in 1841. The clay was sliding back into the side cutting from which it had come. The slips, the longest of which was up to 110 yards long, commenced at the top of the embankment in a conchoidal pattern.

Brunel's resolution to the problem was to instruct the contractor to drive stout beech piles along the base of the embankment with the intention of pinning the slip to the undisturbed sub formation. This proposal was quickly executed but failed to stop the progress of the slips. The lateral pressure or super-incumbent load on each pile was calculated by Richardson to be 200 tons on each pile. As a consequence the piles were snapped clean at the slip plane. Other solutions were tried such as fire holes to burn the clay but to no avail.

Richardson came to the conclusion that the problem arose at the slipping surface and that the solution was to somehow break it. With Brunel's permission he proposed a series of pits 6 feet square dug at 6 feet intervals at the base of the embankment, taken down to 18 inches below the slip surface. His concern was speed in the execution of the work to avoid undue stress at the slip surface whilst the excavations were taking place. He therefore decided to excavate the pits alternately. Immediately upon reaching the required depth the pits were filled with rough stone from a coral rag formation excavated from a cutting further along the line. The exercise proved an immediate success. As a result Richardson decided not to immediately proceed with alternate pits or counterforts and eventually decided they would not be required.

The line in the Stroud Valley at Chalford Valley was cut through the south side hill 50- 100 feet above the valley bottom. At this position the geological formation was Inferior Oolite overlain at about 150 feet by a Fullers Earth formation comprising fullers-earth clay interspersed with blue rock. The Fullers Earth formation was in turn overlain with the Great Oolite. Richardson observed before excavations began that there was an ancient slip through which the line would cut. It extended for about a quarter of a mile but was stable. He also observed three springs came to the surface but disappeared in the ground above the line. He was concerned that the railway excavations would promote instability in the ancient slip should there be prolonged period of rain. He was also correct in his assumption that the excavations would expose the slip surface and discovered during the progress of the work that it was entirely composed of Fuller's earth clay.

Richardson brought his concern to the attention of Brunel and expressed his opinion that the excavations had removed the buttress formed by the oolite mass and that in time the old slip would advance. He proposed that precautions should be taken by providing a drain above the line to divert the springs but Brunel would not sanction the expense. Richardson's prediction was later proved correct. After the line was opened for traffic and following prolonged period of rain the old slip moved and raised the track some 3 feet in one night causing extensive disruption and unnecessary expense in remedial works.

Sometime during the course of the works a further unforeseen difficulty arose for Richardson to resolve. A landowner and timber merchant demanded a passageway across the railway cutting. His requirement was for the timber logs from the woods above the track to slide in an unbroken descent to the canal below. The slope of the hill was 1 in 3. Richardson's solution was to design and construct a bridge so slender in proportions and geometric design that it impressed Brunel to such a degree that he would not allow parapet walls to interfere with its beauty and proportions. Only light iron rails were allowed. The bridge remains today as a fitting memorial to the artistic talent Richardson brought to bear on his work. See Photo 1

Ross-on Wye

Following his work on the Swindon-Cirencester-Stoud line Charles Richardson was appointed by Brunel to the position of Resident Engineer on the Hereford-Ross-Gloucester line. He relocated his place of residence from Chalford to Brookend House in Ross.

Immediately upon his appointment Richardson was not satisfied that the best route had been chosen for the line and with an assistant, he surveyed a new route. His revised proposal was approved by Brunel and adopted by the railway company directors. As a result a new Act had to be obtained and consequently work was held in abeyance.

It was whilst at Ross that his cricketing prowess was noted not only in the reports in the local newspapers but also by the directors of the company who complained to Brunel about his devotion to the sport. Brunel was so concerned by the directors complaint that he wrote to him. *"As to the apparent want of energy on your part in attending to the companies works...contrasted with the alleged devotion to amusement and among other things to cricket I don't know why you should be less of a slave to work than I am. I don't know why a man having the advantage of country air and very light work should indulge therein. You must endeavour to remove any such grounds of observation".*

It was whilst he was at Ross that Charles Richardson designed the first cane spliced cricket bat and invented a bowling machine.

This was not the only distraction for Charles Richardson as it was here that he met and married his wife Mary Frances Thomson the eldest daughter of C.E.Thomson, Surgeon on 19th Aug 1854. He was 40 years of age only three years younger than his mother in law.

The next landmark in his career came in 1858 when Brunel invited him to be the Resident Engineer on the Bristol-South Wales Union Railway. He was unemployed at the time and was therefore agreeable to the rather low salary of £300-£450 compensated with the offer of beautiful countryside and cricket.

Richardson sold his house at Ross complete with all furnishings and his wherry river boat complete with blades and moved with his wife and first child to Almondsbury in Gloucestershire

The Bristol -South Wales Union Railway

The scheme was complex and included embankments and cuttings, also a tunnel and two large ferry piers, one at 545 yards long on the Gloucestershire bank of the Severn and the other 236 yards long on the Monmouthshire side.

Once again Richardson was confronted with problems of land slips, this time in the Ashley Hill Valley where he again encountered lias clay and running water in the form of Horfield Brook. However, although subordinate to Brunel, he was not restricted in his recommendations to resolve the problems as by now his reputation for dealing with such matters had preceded him and the Board of Directors, no doubt on the recommendation of Mr Brunel allowed him to do whatever he thought was necessary.

Twelve months into undertaking this project an important event took place which would influence the remainder of Richardson's career as a civil engineer. It was the untimely death of Isambard Kingdom Brunel on the 15th September 1859. Brunel's death resulted in Charles Richardson, with Mr R.P. Brereton being appointed Joint Engineer in Chief to the B&SWUR.

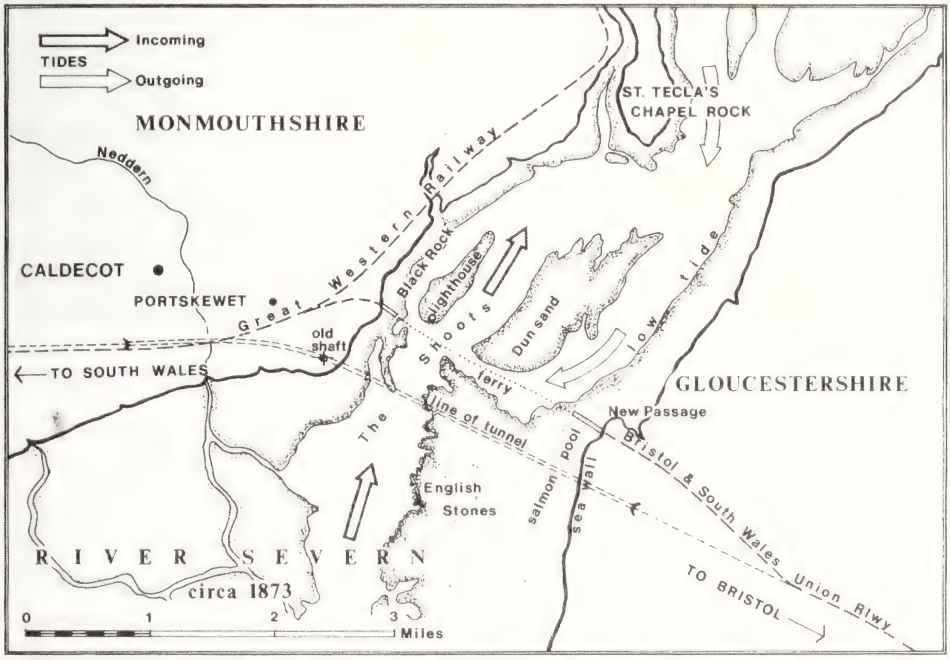
Work commenced on the project at the Almondsbury Tunnel (now Patchway Tunnel) in September 1858 and it was here that Charles Richardson noted that the arisings from the excavation was coal measures shale clay suitable for the manufacture of bricks. As a result of his discovery in 1865 he purchased Cattybrook Farm and established on that farm the Cattybrook Brick Company for the manufacture of vitrified bricks suitable for use in any type of construction but in particular civil engineering projects.

The Portskewett Pier

It has previously been mentioned that the project required the design and construction of two land piers on the banks of the Severn. These large structures were constructed of bulk timber which required deep anchor foundation into the exposed tidal rocks and foreshore. It was whilst the excavations of the pits in river bed on the Welsh bank were in progress that Richardson made a significant discovery in respect of the peculiarities and nature of the Severn tidal flow.

Since time immemorial there had been a desire to have direct communication between Bristol and South Wales for passenger and freight traffic either by bridge or subaquatic tunnel. The B & SWUR, although an improvement, was not the complete answer to the needs of Bristol or South Wales. From his observations Charles Richardson deduced that it would be possible to construct a tunnel for railway connection between Bristol and South Wales under the Severn.

Brunel, in correspondence with the Duke of Beaufort in a letter dated 30th May 1854, said that it should be possible to overcome the difficulties of the Severn and expressed a belief that "*within 50 years there would be a bridge or tunnel across the estuary*". The preferred location for either a bridge or tunnel was at the site of the New Passage Ferry. It was south of the River Wye with a direct access to Cardiff and South Wales with rock formations on either foreshore.



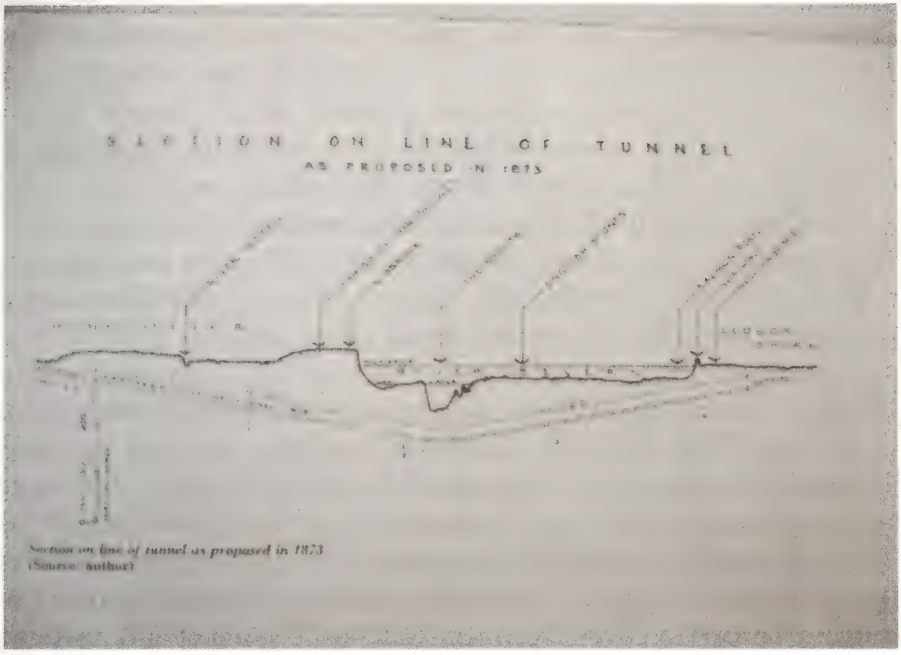
The directions of the tidal flow of The River Severn at New Passage

The principle problem, be it for a bridge or tunnel, was not the 33 foot tidal range, but the section of the river known at The Shoots. This is a deep trench in the river bed, 450 yards wide, visible at low tide, situated half a mile from the Welsh shore.

Its precise depth was not known, neither was the condition of its bed. What could be observed at low tide was the extensive bed rock of the river comprising of trias, marls, and sandstones and a conglomerate called dolomitic, a material formed of rounded pebbles and boulders embedded in a hard matrix, the whole presenting a surface very resistant to erosion.

Richardson discovered that, after every tide, the navvies had to remove from the pits boulders and gravel brought in by the flow of the water. He therefore deduced that if such material was constantly flowing over the river bed then the surface condition of the rock would uniformly apply whether exposed or submerged, consequently any soft or deleterious material would have been removed over the ages by the constant ebb and flow of the tide, including the Shoots. He further deduced that any residual cracks or fissures would be impervious as they would be filled with compacted sand and mud. It was from these observations Richardson came to the conclusion that it would be a feasible proposition to construct a tunnel under the River Severn.

In the year 1862 Charles Richardson put his idea and proposals for a tunnel to Mr Leonard Bruton, Secretary of B.& S.W.U.R with an estimated cost of half a million pounds exclusive of inshore approaches. He was encouraged to proceed by Mr Bruton, and the contractor working on the B.&.SWUR, Rowland Brotherhood of Chippenham. Brotherhood agreed with Richardson that his estimate was correct, subject to a contingency sum for unforeseen water ingress. As a result he produced a preliminary scheme and presented it to the directors of the B& SWUR. Richardson's proposal was favourably received by the directors and he was further encouraged to proceed with a detailed section and survey of the river bed. From this survey he produced his preliminary plans and estimates for The Severn Railway Tunnel.



Cross Section of the bed of the River Severn and line of the proposed tunnel.

On the 1st January 1863 The Bristol & South Wales Union Railway was formally opened for passenger traffic. In the same year Richardson's plans for a rail tunnel under the Severn were deposited with Parliament but failed to receive a second reading through lack of financial support.

His plans were again presented a year or two later but again failed for the same reason. Meanwhile proposals, in competition with Richardson's tunnel were being prepared for either a bridge or tunnel. In the ensuing years there were eight alternative proposals tabled for consideration. The most prominent being Fowler's Great Western and South Wales Direct which although receiving Parliamentary approval failed, as did Richardson's proposed tunnel, for lack of financial backing.

In 1865 as well as establishing the Cattybrook Brick Company Charles Richardson was also appointed Chief Engineer of The Bristol Harbour Railway. This was a relatively small line but very complicated. It required a viaduct, a tunnel and a bascule bridge, very little of which remains today. Its route was from the railway at Temple Meads to the Bathurst Basin. The viaduct was to traverse the Bristol-Bath-Wells road. The tunnel was under the churchyard of St Mary Redcliffe. The bascule bridge was located at the lock entrance to Bathurst Basin, between the General Hospital and The Ostrich pub. See photo 2. Note this was a broad gauge line.

Although he was involved in other projects such as preparing plans for the Exe Valley Railway, Charles Richardson continued to pursue his vision of a sub-aquatic crossing of the Severn Estuary. He was, to some degree, encouraged by the absorption of the B&SWUR into the GWR The board of the GWR was keen to exploit the coal trade of South Wales and sought to promote a direct line either by tunnel or bridge. Competition grew between Richardson's tunnel and Fowler's bridge; Fowler was at that time the engineer for the GWR, but his scheme for a bridge was rejected in favour of a tunnel. The directors of the GWR preferred the option of a tunnel as it avoided confrontation with the Admiralty and the Severn Navigation lobby. Accordingly in 1872 Richardson's proposals were again put before Parliament this time promoted by the directors of the GWR. Under their direction and at a cost to the company estimated at £750,000.

The directors had certain reservations about the undertaking and insisted that Richardson obtained support from an engineer of the highest standing. He first approached Thomas Harrison, of The North East Railway who declined, His concern was the unknown condition of the rock formation at the bottom of the Shoots where fissures may be sufficient to render the tunnel impracticable. Sir John Hawkshaw considered the scheme feasible and gave it his consent.

The Parliamentary Bill was passed. Charles Richardson was appointed Engineer for the project with Sir John Hawkshaw as Consulting Engineer.

The Severn Tunnel

"If it were above ground, the Severn Tunnel would be a Grade 1 listed monument preserved as an example of Victorian engineering enterprise and skill" Lord Crickhowell (Lords Hansard 17th February 1999)

Prior to work starting it was necessary to carry out a very accurate survey of the proposed route as it was to be within a stipulated width of 300 yards. At that time there was no recognised procedure for such a task. It was left to the inventiveness and skill of Richardson to devise a method which accommodated the rise and fall of the tide and the fact that there was only still water within the Shoots for 20 minutes between tides. His method and procedure for the task he set out in a paper which he read to The Bristol Naturalist Society on the 28th June 1887.

The survey confirmed Richardson's earlier belief that the bottom of the Shoots was free of fissures and something like the ridge and furrow of a ploughed field. In his own words *"as might have been expected from the nature of the wearing away by gravel running longitudinally up and down".*

He observed from his own experiences whilst working on the Union Railway, and from historical facts, that under certain meteorological and spring tide conditions extreme high tide levels could be reached that would, unless precautions were taken, overwhelm the sea walls and drown the mouth of the tunnel. He cited two recorded instances one at Kingston Seymour where on 20th January 1606 the water lay five feet high in the church and surrounding land and again in 1702 at a church in Peterstone where a lead plug was let into the wall to mark the height of the water following a great storm.

Richardson concluded from his observations that the height of the sea banks around the cuttings in the meadows would have to be raised to 16 feet. His finding was derided by one of the directors during a site inspection 1883 but he was later proved correct as on the 18th October 1883 the entire works on the Welsh side were flooded as a result of a severe S.S.W. gale coinciding with a high spring tide.

The October flood 1883

After the survey of the Shoots was completed and the centreline established it was decided that the first objective would be a heading under the Shoots to confirm the anticipated conditions of the rock and thus the practicability of the project before the outlay of expenditure for the entire work. Richardson's original plan was to erect a watertight caisson on the edge of the Shoots of sufficient size to accommodate a winding engine and pump and to excavate down to invert level and drive out a heading under the Shoots.

His plan was thwarted by the Severn Navigation lobby, supported by the Admiralty, who insisted on free passage without impediment for their ships. Two further shafts which were intended to be placed on English stones also had to be abandoned. Charles Richardson wrote, *"This opposition seemed somewhat captious on the part of the navigation authorities who might have had to put up with piers of a bridge all across the river and who had already been beaten in their opposition to the bridge scheme of Mr Fowler, a few miles up."*
As a result of the objection a shaft, 15ft diameter was sunk on the shore at Sudbrook in March 1873. It reached bottom in December 1874 and the heading was commenced in Pennant sandstone which was very wet.

As a consequence of the navigation ruling Richardson realised that the traditional method of aligning a tunnel would not be suitable for the Severn Tunnel as the distance between the shafts would be too great and lead to unacceptable inaccuracy. The traditional method (as was Richardson's first experience with Brunel on the Box Tunnel), was to set out the tunnel at ground level and sink a series of shafts along its length. The centre line would be marked on head trees across the shaft head, plum bobs would be dropped to the bottom. A line of sight for the pilot, or bottom headings, which would be advanced in two directions, would be taken and the centre line marked on the head tree supports along the length as the pilot tunnel advanced. As the heading was much smaller than the completed tunnel (approximately seven feet square) any discrepancies would be easily corrected prior to the excavation being enlarged to its full size.

Richardson's problem was that there would be no intermediate shafts in the river, therefore the only points of setting out would be from those located on the banks two and a quarter miles apart. Richardson resolved it by purchasing a special transit instrument form Troughton & Simms which could be rotated through 360 degrees in the vertical plane, allowing vision through its base, as well as 360 degrees in the horizontal plane. He then devised new apparatus consisting of piano wire mounted on solid base plates with a unique method of adjustment. He also introduced what was new and untested at that time, electric light, which greatly improved the level of illumination at the base of the shaft and headings Richardson describes in detail his modus operandi in a paper he wrote in 1887 a précis of which is set out below .

'The instrument was set up on a special mounting on the top of the shaft exactly on the centre line of the tunnel. The centre line was projected to the bottom, negating the use of plumb bobs. After taking several readings on the opposite bank to align the instrument, which as stated previously was two and a quarter miles away, the instrument was rotated in the vertical plane to face down to view the piano wires at the bottom of the shaft. The wires were brought into the precise line by adjustment. The operation was repeated many times until Charles Richardson was satisfied that all discrepancies had been removed and the true centre line established within the heading. This method was repeated throughout the entire project. When the headings eventually met in the centre of the river, the Engineer-in-charge reported them as meeting *"dead true both in line and levels"* thus proving Richardson's expertise to be most perfect. It must be born in mind that not only was the tunnel to be straight but that the invert dipped 1-100 in both directions from the entrance portals to its lowest point under the Shoots

After four years of work the heading had successfully passed under the Shoots, thus proving the viability of the project. Richardson prepared drawing and specification for letting the work out to be completed by a contractor. All tenders returned were in excess of Richardson's original estimate, due mainly to the contractor's contingency sums for the unknown ground conditions. It was then decided that in order to negate this problem the heading would be extended to the entire length of the tunnel. Contracts were let to contractors for new shafts to be sunk and headings driven east and west. The Sea Wall shaft on the Gloucestershire shore was begun as were two new shafts on the Welsh side. The work under the Severn from the Sudbrook shaft was continued with the existing GWR labour force. Progress was disappointingly slow due to the excessive water and the hardness of the dolomitic rock.

The directors of GWR were now keen to see progress of their tunnel for them to exploit the South Wales coal trade, as their competitor's bridge at Sharpness was under construction. It is obvious that the relationship between Richardson and Gooch (Chairman of GWR) was becoming strained as Gooch records in his diary May 1st 1878. *"I went to the Severn Tunnel and spent the day there going up to the face of the heading. All going on very well, but very slow. The day was fine with some showers. This is an anxious job for me. Richardson the engineer has no go in him and does not move without consulting me, making me almost the engineer.*

Springs, producing copious quantities of water, were encountered necessitating a flood door to be built 340 yards into the heading. This was a solid structure of brickwork with a substantial door and sluice valve built to prevent flooding in the event of a pump breakdown. This flood wall was to have a great significance later in the progress of the work

Disaster Day

October the 16th 1879 disaster struck when an enormous spring was struck 354 yards east of the Sudbrook shaft causing the entire works to drown with the exception of the Sea Wall heading. The heading under the river had reached a length of 3,370 yards or nearly 2 miles from the Sudbrook shaft and was within 138 yards of linking with the Sea Wall heading. After six years the project was at a standstill. The headings were drowned on the same day as the opening ceremony of the Severn Railway Bridge at Sharpness.

The drowning of the work to all intent and purposes finished Richardson's career. The board of the GWR replaced him as Engineer-in-Charge with Sir John Hawkshaw. Charles Richardson was retained as Consulting Engineer.

Sir John Hawshaw

Mr Thomas Walker

Sir John immediately appointed Thomas Walker of London as contractor for the entire work. It took Walker twelve months to bring the water under control and to clear the tunnel before work under the Severn could proceed.

In the ensuing period, Sir John Hawkshaw made some major alterations to Richardson's design. The first was to lower the invert by 15 feet causing the existing heading to be now the top heading and the drainage tunnel under the Shoots to be re excavated and for all the shafts to be lowered by 15 feet. The gradient on the Welsh side was increased to 1 in 90. The gradient on Gloucestershire remained at 1 in 100. He changed the brickwork bond to ring work as opposed to Richardson's preferred vertical bond and increased the brickwork thickness from 27 inches to 3 feet.

After a further seven years the tunnel finally opened for goods traffic on 1st September 1886 and passengers on 1st December 1886. See Photo 3. The story of the building of the tunnel following the drowning is set out in a book by the contractor Thomas A. Walker "The Severn Tunnel its Construction & Difficulties 1872-1887" in which Charles Richardson's contribution to the tunnel is barely mentioned.

Following the publication of Thomas Walker's account Charles Richardson felt obliged to record the facts as he knew them, which was published September 1888.

Extracts of some of his thoughts are;
"They then asked Sir John to undertake the main responsibility of the work and made us Joint Engineers of whom he was chief. From that time I could advise, but he could decide"

"I believe the spring could be shut back in a month by boring an 18inch hole into the heading and pouring in liquid cement till that part of the heading was filled up but the Engineer-in Chief would not hear of it."

"My opinion was altogether against the depression of the gradient after five years driving the heading at its then level, all across the river, and finding under the Shoots the strongest and safest rock possible. I suggested, in preference, the driving of a top heading 20 feet above along the 300 yards of deep water .....it could have been done in 20 weeks: here again my advice was disregarded."

"The 15 feet lowering also increased largely the flow from the Big spring; for when it was tapped a second time on October 10th 1883, at the 15 feet lower level, and 90 yards nearer to the shaft, it rushed in in a fourfold quantity"

"It may be mentioned here, that when the contractor began to open out the heading under the Shoots into the full size tunnel, he also became of opinion that the 15 feet lowering had been unnecessary, for on one occasion when he, Sir John and I were standing at the shaft head, about to go below, he suddenly remarked to Sir John" " We were afraid in the wrong place Sir John"

"the brickwork all through, both in the tunnel and in the bridges outside was very much heavier than I think was needful, and that all the arches have been built in rings of brickwork instead of the vertical bond".

"I have long considered ring work both weak and untrustworthy. I have not used it myself for twenty five years"

This kind of brickwork, and the depression of the gradient, are the only departures from my original plans. The result of the 15 feet depression is that;(1) the trains have 1,500feet more gradient to climb; (2)The pumps have to raise the water 15 feet higher; (3) The water pressure on the brickwork was increased 7lb. on the square inch; (4) the flow from the Big spring was very largely increased by tapping it at the 15 feet lower level; and (5) the additional cost, together with that of the unnecessary brickwork, has been something like half a million of money.
Charles Richardson September 1888.

In his later years Charles Richardson prepared several papers; an account of the Severn Tunnel was read before the Clifton Scientific Club in 1887, and in the same year he gave a paper on arches to the Bristol Naturalist Society of which he was President for many years. Charles Richardson died 10th February 1896, at the age of 81 years six days after a paralytic seizure at his house in Berkeley Square, Bristol. He was buried at Almondbury Church where there is a window dedicated him as the originator to the Severn Tunnel.

From his obituary published in the Institute of Civil Engineers

"In temperament he was benevolent, genial, peaceful and contemplative, while his straightforwardness and honour were such as are rarely met with. His modest disposition prevented his being known to fame and it is only those who were intimately acquainted with him to realise the nobility of his character. "

From the Biographical Dictionary of Civil Engineers:
"A wealthy background meant that engineering was something of a hobby, and a natural modesty meant that his undoubted engineering talent was not known widely beyond those working with him. Better known contemporaries achieved more with less ability"

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Charles Richardson's Life Time Line

1814	Born.
1833	Completed his schooling.
1834	Apprenticed to I.K.Brunel, working on Box Tunnel.
1838	Resident Engineer Swindon – Cirencester Railway.
1846	Resident Engineer Hereford-Ross- Glos.- Railway.
1858	Resident Engineer Bristol-South Wales Union Ry.
1859	Joint Engineer i/c Bristol South Wales Union Ry
1863	Presentation of proposals for the Severn Tunnel.
1865	Created Cattybrook Brick Company.
1865	Chief Engineer, The Bristol Harbour Railway.
1872	Chief Engineer, The Severn Tunnel Railway.
1873	Work started on the sinking of the Sudbrook shaft.
1879	Replaced as Chief Engineer by Sir John Hawkshaw
1886	Severn Tunnel opens for traffic.
1888	Richardson publishes his paper in defence of his plan.
1896	Richardson dies at 10 Berkeley Square Bristol. and
1896	.....Buried in Almondsbury Churchyard.

Notes on Spiders Found in and Around a Basement Flat on Worrall Road between 2010 and 2013

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Summary
During a four year period living in a basement flat in Worrall road, 23 different spider species were observed and identified. The list of species is presented with accompanying observations on microhabitat use and references to current distributions.

Introduction

Spiders are probably the most frequent macroinvertebrates to be found inside our homes and the immediate surroundings. In return we have awarded some species vernacular names including House Spider (for *Tegenaria* spp.), Cupboard spider (*Steatoda grossa*) & Cellar Spider (*Pholcus phalangioides* & *Nesticus cellunanus*). For some species the likelihood of encountering them in natural surroundings away from buildings is so low that they must be considered truly synanthropic, whereas other species occur in a variety of habitats in nature and occasionally indoors. The relatively little effort required to find spiders indoors is in contrast to the gaps in the distribution records of many species, which may be explained by a lack of recording inside buildings, probably due to a focus instead on examining sites of natural interest (Russell-Smith 2002). Spider surveys examining buildings and the nearby vicinity can produce a total of 29 species (Russell-Smith *et al* 2013) and even 52 species over a 22 year period (Williams 2012). Given the increase in urban land use it is interesting to try to understand how our homes and outhouses are suitable as spider habitat and what effect urbanisation might have on future spider diversity.

At the scale of a spider, a house provides a range of microclimates with varying temperature, humidity, shelter and prey that may be differentially suitable for each species. Our homes and buildings are not homogenous: for a spider, a house can be a permanent home, a temporary shelter or a perilous trap. Nor is every house the same – a damp and unmaintained basement flat is quite a different place to a modern double glazed house. As the distribution of spiders is constantly changing, those that we encounter at home represent a sample of their regional distribution. Presently spiders are under-recorded, and this is illustrated by the fact that at the time of writing, many of the species listed here have not previously been recorded in central Bristol (BRERC 2013), though undoubtedly they are more common than records would suggest.

Methods

During the four years an effort was made to identify each different spider species that could be found within the house and the immediate surroundings. This included grubbing in the garden, pooting spiders from underneath furniture, and potting spiders from the walls. Surveying was not systematic but extra effort was made to collect species that at first sight looked new, and to thoroughly investigate all areas. Immature spiderlings were reared in plastic pots until they could be identified. Mature spiders were preserved in 70% isopropyl alcohol and identified under a microscope with comparison to illustrations in Roberts 1985 and 1996. Specimens of all but the commonest species have been deposited in the collections of the Bristol City Museum & Art Gallery. The need to retain voucher specimens for nearly all species is a mandate of the British Arachnological Society (Harvey 2008).

Description of the habitat

The flat occupied the entire basement of a Victorian terrace on Worrall Road near to the Downs and included recessed concreted areas outside to the front and rear and an external cupboard below the street level. The bare concrete surfaces outside the front were packed with potted plants and other garden furniture, greatly increasing the diversity of surfaces and microclimates for invertebrates and leaving some areas completely undisturbed throughout the four year period. A cupboard-sized greenhouse offered permanent shelter from rain, high summer temperatures and protection from winter frost. Large outhouse compartments below street level offered permanently dark, damp and deteriorating brick work.

The front of the flat was south-facing and received some direct sun whereas the rear was in permanent shade and damp receiving rainwater runoff from the surrounding gardens at higher levels. There were considerable gaps underneath the external doors, and the typical Georgian window frames were decomposing leaving many small entrances. Various ventilation bricks and a kitchen window fan gave unobstructed access to the interior for slugs, woodlice and most certainly spiders. The insides of the flat, although regularly hoovered, provided areas of permanent shelter inside cupboards and behind damaged skirting boards. Rising damp was clearly visible around many walls providing permanent levels of high humidity, and undisturbed recesses were quick to sprout various colours of mould.

Species list & notes

Many spider species lack widely accepted common names and so in the following list a pluralised family name is given for these. No common name has been given where the spider is atypical of the family.

***Araneus diadematus* (Garden Cross Spider: Araneidae)** Although this species was clearly present from late spring onwards, it became more noticeable towards August as large individuals made ever more impressive webs to counteract the impending Autumn weather. Height of support was probably a more important factor in determining web location than proximity to human structures – the steps down to the house offered a large open space across which to construct a web, but a tall plant stem was equally adorned. Probably the most well-known garden spider it would be a shame not to have been encountered at Worrall Road, and the tiny yellow and black spiderlings were a sure sign of spring.

***Amaurobius ferox* (lace-weaver spiders: Amaurobiidae)** This impressive looking spider is the largest in its genus (Jones 1989) and was most abundant in the darker areas outside the front of the flat, its presence immediately noticeable from the lacy web surrounding the retreat in cracks in walls. The drainage holes of most plant pots were home to a large adult female. Many sources refer to *A.ferox* as being less common than *A. similis* (SRS 2013), though it has been noted as being commoner in the south and abundant in cellars (Savory 1953), so would be interesting to know if Bristol is a stronghold for this species. *A.similis* is also said to occur in houses (Roberts 1996), however humidity may be a determining factor in the exact preference for habitat between *A.ferox* and *A.similis* (Bristowe 1971). The Spider Recording Scheme website gives a graphical analysis of the habitat recorded for every species and currently this shows that *A.ferox* is more often found in and around buildings (SRS 2013). *A.ferox* has been found in damp vaults such as those at Highgate cemetery, also occupied by cave spiders (Milner 2013), and my experience agrees with Bristowe (1971) that *A.ferox* prefers damp and shady walls comparable to the entrance to a cave.

On several occasions I spotted a mature male running across the walls indoors – males of *A.ferox* are immediately identifiable by the white reflective area of the bulb of the palp when viewed from above. They are distinguished from similar spiders by the rounded carapace, large size, dark colouration and the velvet texture of the abdomen, they are also very placid and easily handled, with no display of aggression (to humans).

Clubiona terrestris **(sac spiders: Clubionidae)** A single specimen was observed walking across an internal wall of the flat. This fits with the SRS website description that is it found occasionally indoors (SRS 2013). The slow and methodical ambulatory style of *Clubiona spp* is interesting to watch as it appears most unlike other spiders found indoors. The lighter colouration and silvery pubescence give this spider a unique appearance, as do the prominent rear spinnerets.

Dysdera crocata **(woodlouse-eating spiders: Dysderidae)** Were it not for the smaller in the genus (*D.erythrina*), this woodlouse-eating spider would be unmistakable. *D.crocata* is larger than *D.erythrina* which I have found in more natural habitats such the scree slopes of the Avon Gorge gully. In contrast ot *D.erythrina* It has been said that *D.crocata* is often synanthropic (Harvey 2009), and in my experience it is most likely to be found on warm days by lifting up flower pots. Although shunning light, *D.crocata* seems not to be put off by low humidity and in captivity will spin a thick silken cell in which to overwinter or generally not move for months on end: warmth is perhaps more important than humidity for this species.
Whilst the location of the spider was predictable, unlike *Amaurobius ferox* its presence was not reliable, indicating that individuals may travel over larger areas in search of prey, even though the front of the garden was permanently home to countless woodlice. Occasionally specimens would appear indoors, where they are noted as being casual visitors (Russell-Smith 2002),and upon their discovery cause much commotion prior to defenestration.

***Enoplognatha ovata* (Candy-Stripe Spider: Theridiidae)** In most spider surveys this spider is encountered whilst sweeping low vegetation and it is listed as being extremely abundant (SRS 2013). The sunny patch of shrubs on the higher level of the front garden next to the road was home to many individuals of the various genetically determined colour morphs, and they were never encountered in or near the flat. Although easily distinguished from most other spiders, the coastal range of *Enoplognatha latimana* which is virtually identical to *E.ovata* (Oxford 1992) necessitates care when recording new populations - and closer examination of assumed *E.ovata* often reveal *E.latimana* (Williams 2011).

***Episinus maculipes* (Y-Weaver Spider: Theridiidae)** The presence of this rare and unusual spider amongst potted plants to the rear of my flat was a remarkable occurrence and required the identification to be verified by Peter Harvey (British Arachnological Society). This interesting Genus rests holding lines of web in each leg making various shapes – I observed *E.maculipes* forming the Y-position with two front legs each holding a strand and a single rear thread running from the spinnerets. This species has a national status of RDB3 and was first recorded in Britain in 1929, the male never having been recorded in Britain up to at least 1971 (Locket et al 1971). I noted several individuals of both sexes as immature in April 2013 and reared them to maturity in June.

The reverse taper to the abdomen is easy to spot in comparison to other small spiders, and in contrast to *E.truncatus* and *E.angulatus, E.maculipes* has a pale area in the central part of the sternum. If not endemic to Worrall road there is a chance that a gravid female or egg sac of *E.maculipes* arrived on one of the mail-order trees that I purchased recently. Further recording focussing on this species may turn up more unusual populations along the south coast where its range is increasing (STS 2013), having been found at Lyme Regis in 2005 (Cumming 2005). I have yet to investigate whether these individuals moved with my bonsai trees with me to Southville.

***Harpactea hombergi* (Dysderidae)** On several occasions I encountered *H.hombergi* running erratically at head height across interior walls of the flat at night. This extremely fast spider superficially resembles a very small *Dysdera sp.* however it has a much thinner abdomen especially in males, and less red colouration. Strikingly patterned legs of alternating shades of brown are noticeable at close range, and I immediately noticed the sensory function of the front legs (Bristowe 1971) which were waved around in front of the head in the search for prey. It seems likely that the indoor spiders were opportunist night time hunters, as *H.hombergi* is a known visitor into homes (SRS 2013) and other dry situations (Russell-Smith 2011). I also came across more sedentary females whilst lifting up bricks in the drier parts of the front garden, such as underneath the greenhouse.

***Labulla thoracica* (Linyphiidae)** Males of this large and ornate money spider bear disproportionately large palps including large spiral structures (embolus), which need no special equipment to see. Even immature males bear noticeably large developing bulbs on the palps in the penultimate instar. Both sexes could be found in the darkest dampest areas outside to the rear of the flat, such as inside the compost bin. Specimens were usually found hanging from the underside of a large thin sheet web spreading out from a dark corner. This species is known to inhabit damp and dark areas including cellars (SRS 2013).

***Lepthyphantes leprosus* (Linyphiidae)** Both sexes of this very small money spider were often found individually indoors resting centrally underneath a small sheet web low down amongst piles of shoes. As *L.leprosus* is commonly found in buildings (SRS 2013) this was probably a permanent resident, being small enough to remain undetected and fast enough to avoid the hoover. Currently non-existent in local records (BRERC 2013) it is probably quite common, its minute size and similarity to many others in the genus probably hindering further investigation.

***Lepthyphantes tenuis* (money spiders: Linyphiidae)** Another very small money spider known to occur indoors (SRS 2013), this species was a permanent resident amongst plant pots outside in the sunny area at the front of the flat. Amongst cacti in the cold-frame the web of this species could easily be confused with that of red-spider mite as it is precariously thin and lacks any strong supporting threads.

***Linyphia hortensis* (money spiders: Linyphiidae)** A single male of this species was found on the outside one of the front windows. A fairly common woodland species (SRS 2013) this may have been an accidental visitor from the nearby Downs and Gorge.

***Linyphia triangularis* (money spiders: Linyphiidae)** This very common, mid-sized money spider was a permanent resident in the sunny parts of the garden where it hung underneath large sheet webs below a amongst leaves of potted plants – the tangled network of snares above the web causing flies to crash and be caught. Larger webs were often occupied by a male and female in close proximity, though the design was such that both individuals could have previously built separate webs which merged over time. An adult male was once found indoors on a wall and away from the context of the web and mate was startling in its appearance - this species exhibits sexual dimorphism in the chelicerae, which in the male are greatly elongated and divergent and the cylindrical abdomen is so thin as to appear redundant and quite un-spiderlike. *L.triangularis* occupied a large range of habitats including gardens (SRS 2013) and so its presence is not unusual.

Liocranum rupicola **(wandering sac-spiders: Liocranidae)** In colour and pattern this spider superficially resembles a very small *Tegenaria sp*, with striped brown legs and dark brown chevron markings on the abdomen. It is however more closely related to sac spiders and lacks the long 2 segmented posterior spinnerets of true 'House spiders'. On separate occasions the male *L.rupicola* was found running across interior walls of the flat, and although this species has a national status of notable and has not before been recorded in Bristol (BRERC 2013), it is known to occur indoors (STS 2013).

Nesticus cellulanus **(Cellar Spider: Nesticidae)** In the dampest, darkest places amongst composting vegetation outside the rear of the flat, there was often at least one specimen of this attractive spider. This could be confused with *L.thoracica* due to its similar size, colouration and habitat – but the contrast of dark abdominal and carapace markings against the pale yellow background colour and lack of any white spots make *N.cellulanus* readily identifiable. On some specimens observed the dark pattern was entirely absent, thus making them the only large pale yellow spider to be found in this habitat. Also, it does not spin a sheet web but instead a tangled network of threads similar to the comb-footed spider family to which it is morphologically related. As this spider is known to live in dark and damp places (Nicholson 2007) and in cellars indoors away from central heating (Russell-Smith 2002) and could reliably be found in the rear outside area I would speculate that it is a common Bristol resident which currently is under-recorded.

Pholcus phalangioides (Daddy Long Legs Spider: Pholcidae) *P.phalangioides* was ubiquitous in every room throughout the year, usually occupying a corner of the ceiling but also occurring low down in generally undisturbed areas such as between the fridge and cooker. This synanthropic species, originally from Asia (Hubert 1995), is found almost exclusively in buildings (SRS 2013), with occasional record of individuals in hollows in trees (Russell-Smith 2011). The permanent residence of many adults in the flat would indicate that there is an abundance of prey to sustain them. Whilst there is evidence of Pholcus preying on spiders (Early 2007), clothes moths and flies must also get caught. Although technically an introduced species, *P.phalangioides* was noted as early as 1929 as being 'a common British spider' (Savory 1928).

***Psilochorus simoni* (Pholcidae)** *P.simoni* was a permanent resident in dry situations indoors and also the outside cupboard. This species is similar in overall appearance to the much larger *Pholcus phalangioides* however it was only ever found close to the ground and the abdomen is more globular in shape. Originally noted as being associated only with dry wine cellars (Locket et al 1951), more recently *P.simoni* has been found in other indoor environments (Locket et al 1971). The ability to survive and reproduce in dry conditions and occupy very small spaces make *P.simoni* likely to be much more common than records suggest, and it is suggested that it is an introduced species from the US (Huber 1995).

***Salticus scenicus* (Zebra Jumping Spider: Salticidae)** This very active and attractive jumping spider was always found hunting in full sun on the external walls at the front of the flat. The large flat expanse of brickwork would seem a more fruitful hunting ground for this visual hunter than nearby vegetation, and its occurrence is more often than not stated as being on sunny walls (Locket et al 1951, Harvey 2005).

***Segestria florentina* (Tube-Web Spider: Segestriidae)** Several large tube-webs of *S.florentina* could be seen protruding from gaps in the upper woodwork of the front door frame and external cupboard. Under cover of the porch, these areas received almost no rainfall and were sunny for at least some of the day. The webs are similar in design to *S.senoculata* but the large diameter of the tubular entrance and height above ground are characteristic of the species, although it was not always clear if the webs were occupied. I have seen a female tube web spider on an external wall of the 4th floor of a block of student flats in Clifton and specimens up to 9 meters above ground are documented (Haigh 2010). In captivity I have observed a female *S.florentina* construct a silken retreat in the upper portion of the available enclosure, adding to the design each night until the opening tube and radial threads are finished. Large females do not seem well adapted to the outside world and easily injure themselves once evicted from their web. I did observe immature specimens indoors occasionally and adult males are regularly encountered indoors in Bristol where they attempt to bite if captured. The current known published distribution of *S.florentina* appears scarce (SRS 2013) although in places such as Bristol where it is has been known for many years evidence suggests otherwise and almost every building in central Bristol sports *S.florentina* webs in various states - usually in large numbers and close proximity. The tube webs of immature specimens are sometimes totally exposed, lining recesses in brickwork - this leaves me to wonder at what point the spider decides to embark on what must be an extremely perilous journey to find a larger cavity in which to build a home. The size and microhabitat of *S.florentina* appears to overlap with *A.ferox* and undoubtedly similar sized individuals would be possible prey for each other, though humidity might be a limiting factor for each species. It would be interesting to see how known distributions of each species change over time as *S.florentina* spreads having been first recorded in North Gloucestershire in 2009 (Haigh 2009).

***Segestria senoculata* (Snake-Back Tube Web Spider: Segestriidae)** The small tubular entrances and radial threads found in sunny locations amongst dry bricks were characteristic of the presence of this spider. Lifting such bricks In August revealed a female surrounded by young inside the exposed retreat lined with thick silk. The shape, behaviour and web of *S.senoculata* are similar to those of immature *S.florentina*, but the black abdominal markings of *S.senoculata* are more pronounced and they are more usually found near the ground. Males were encountered running across the internal walls of the flat, presumably in search of females, and when captured they had the behaviour of leaping from my hand on a trailing bungee-line of silk which I would not normally have expected for spiders from this family.

***Steatoda grossa* (Cupboard Spider: Theridiidae)** Individuals of all ages and sexes could be found by investigating dry cupboards, loose skirting boards and gaps behind radiators in corners of rooms where this species is usually found (Locket et al 1951). The web constructed by *S.grossa* consists of a 3-dimensional tangled network of threads, proportional in size to the individual, in which the spider rests above a more regular curtain of vertical threads which alert the spider to any prey walking underneath. This adaptation for catching prey wandering below may be why *S.grossa* is usually found near to the ground, especially as juveniles. The spider usually rests in the vicinity of a narrow retreat such as a gap in a wall into which it will escape if disturbed. The longer the area had remained undisturbed, the greater the chance of finding one of the larger females, which in terms of abdominal size is probably the largest permanent resident of the flat.

Immature specimens and males had a striking pattern of pale triangular markings on a reddish brown background colour, whereas large females were a uniform purple-brown except for the single pale band running horizontally across the front of the abdomen which is typical for the genus. *S.grossa* is technically listed as non-native (Wilson 2012) and populations are very easily transported by people which may explain its occurrence in a guest house in North Wales (Davies 2003), with one record of a population turning up in Orkney after a move from Plymouth (Andrew 2002). Although it is nearly always recorded from buildings (SRS 2012) *S.grossa* is showing an increase in the South West where it can also be found in suitable places away from buildings (Dawson et al 2008, Locket et al 1974).

Steatoda nobilis **(False-Widow Spider: Theridiidae)** A single very large female *S.nobilis* was discovered whilst dismantling the greenhouse outside to the front of the flat. Having neither expected nor seen any individuals of this species in the four years previous to this it came as quite a surprise, and a close investigation of the size, overall colouration and genitalia confirmed that this was not simply an aberrant *S.grossa*. Although the only reliable confirmation of the species is the relative width of the middle of the epigyne (Roberts 1996), the abdomen is somewhat larger than *S.grossa*, the legs and carapace are darker and the pale abdominal band is connected to an irregular lattice of lighter dorsal patches. The area underneath the greenhouse had not been disturbed in the four years of living at the flat as it was inaccessible, so I cannot tell how long the female had been there, however the summer warmth and winter shelter are perhaps indicative of further places to search for *S.nobilis* in Bristol. In other countries such as Italy *S.nobilis* has been shown to exclude other species including *S.florentina* (Kulczycki et al 2012).

Evidence suggests that once introduced through human means, *S.nobilis* is likely to establish a population and become naturalised (SRS 2013). In ports such as Barry docks the exotic fruit trade has moved on but *S.nobilis* still occurs in coastal public lavatories (Jones 2006). It will be interesting to see what the effect is on other synanthropic species in Bristol if *S.nobilis* does become established. This false widow spider receives annual press attention when unfortunate specimens are forced to defend themselves, and its presence in Bristol is unlikely to remain a mystery for long due to its non-native status, purported toxicity, original provenance from the Canary Islands (Wilson 2012) and anecdotal associations with bananas (NHM 2013).

Tegenaria Sp. **(House Spiders: Agelenidae)** In contrast to its common name, this genus was most notable for a total absence indoors, having never been observed inside during the period of four years – possibly due to predation by other spiders such as *Steatoda* and *Pholcus*. There was however, usually a cobweb outside the front, just above the drain cover where a male and female could be often observed sharing the same web. One female collected and observed in captivity constructed a white egg sac which she hung in hammock fashion from her cobweb and decorated with material from the underlying substrate. Spiderlings emerged and were released in August. I did not identify the specimen but Bristol lies in a zone of hybridisation between two possible species, *T.gigantea* (=*T.duellica*)and *T.saeva* giving the possibility that spiders with intermediate morphologies may be found (Oxford, G. 2008). There are also several other *Tegenaria* species that could occur indoors so they are certainly worth recording.

Zygiella-x-notata (Missing Sector Web Orb-Weavers: Araneidae) This orb weaver was a permanent resident on the external face of most windows, with several specimens constructing a silken retreat in the shelter provided by the deep gap between the upper window frame and external wall. The missing sector orb webs overlapped each other where several specimens shared the same window. Its preference for windows is well documented (Wilson 2008, SRS 2013) and although considered a native species, it shows highest densities in urban areas and so is at least partially synanthropic, with adults sheltering in their retreats over winter and being spread around the world by man (BAS 2013).

Discussion

With the exception of *L.hortensis* and *E.ovata* all species encountered show varying degrees of affinity for human habitats either to live permanently in, to hunt or to build webs against. Of the 23 species observed, 12 were found indoors at least once and four (*L.leprosus, P.phalangioides, P.simoni & S.grossa*) were considered permanent indoor residents with adults of both sexes occurring frequently in most months. Seven species (*A.ferox, C.terrestris, D.crocata, H.hombergi, L.triangularis,L.rupicola, S.florentina & S.senoculata*) were considered as passing visitors indoors, either as hunters, searching for a mate or perhaps getting lost after mistaking a ventilation hole for a temporary retreat. Externally, dark and damp places were reliable indicators for the presence of four species (*A.ferox, N.cellulanus, L.thoracica & L.tenuis*). Four species were almost exclusively found on external walls (*A.ferox, Z.x-notata,S.scenicus & S.florentina).* According to BRERC 2013 there were no previous records in the central (i.e. urban) Bristol region for six species (*E.maculipes, L.rupicola, L.leprosus, N.cellulanus, P.simoni, & S.nobilis).* According to SRS 2013 Somerset currently holds zero records for *E.maculipes,* four of *L.rupicola,* fourof *L.leprosus, nine of N.cellulanus,* two of *P.simoni* and three of *S.nobilis*.

We therefore don't know enough about local distributions of these species to understand if they prefer urban accommodation but further records may illustrate the trend in years to come. Five species are currently classified as introduced (*P.phalangioides, P.simoni, S.florentina, S.grossa & S.nobilis)* though records exist for all except *P.simoni* dating back to at least the early 1900s. Currently E.*maculipes* has a National status of Rare (RDB3) and *L.leprosus* is Notable (NB).

As demonstrated, the vernacular classification of spiders as either house or cellar spiders provides us with little information about the actual habitat preference or taxonomic identity of species likely to be found around the home. The corner of a room, compost heap or upturned flower pot offer sufficiently different niches for hunting and constructing webs as to maintain constant populations of various species. There is a large overlap in the ranges of domestic spiders, however preferences for light, space and humidity can be used to predict which species are most likely to be found in each zone, with those spiders permanently indoors able to survive long periods of complete dryness. Adaptation to such dry conditions is quite an achievement given that humidity is so important for shedding skin and development in most spiders – and it is no coincidence that the most synanthropic spiders are found in the dry zones - recent research (Dimitrov et al 2012) has shown that humidity loving species are less likely to be spread by humans. Transmission of humid or temperate species is however possible thanks to the trade in nursery plants and this is one theory I have for the anomalous presence of *E.maculipes* in my rear garden, and *S.nobilis* in the greenhouse.

Evidence suggests that many spider species have shifted preference for different microhabitats over evolutionary time (Dimitrov et al 2012), and with human influences on the environment greatly increasing the pace of change it is especially interesting to monitor exactly where each individual specimen is found and make suitable notes when recording them – even brief notes such as height above ground and position in a web may prove very useful in future, as this information is otherwise completely lacking in preserved specimens. The switch to a synanthropic lifestyle must be advantageous for hunters such as *Dysdera crocata* where our garden furniture provide warm and sheltered surfaces and plenty of prey. There is considerable difference in the prey requirements and habitat size of immature spiders in comparison to adults – minuscule gaps in the fabric of a building may be the only entrance point for the offspring of some of the larger species whose presence would be otherwise unexplained (Milner 2013). Inter and intraspecific predation must also occur, with generally larger individuals preying on the numerous offspring and occasional wandering males – but currently which species is outcompeting the others is hard to tell, although in my experience *Tegenaria*, the classic house spider has lost its traditional internal territory in place of the more exotic *Pholcus* and *Steatoda*.

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Weather report for 2012

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Data sources

The BNS began publishing weather data in 1872 with GF Burder's paper on rainfall in Clifton since 1853, and that led me to search for temperature data back to that date. From 1920 until its closure in 2002 the Long Ashton research station provided that data that was published, and since then I have used the Times daily report for Bristol, though since 2000 I have used my own rain gauge. There is an excellent website at www.afour.demon.co.uk which has also traced records from some other sources back to 1853, and I have used these to fill in gaps. A long series is crucial to any understanding of the continuous process of climate change, which is normally defined as the average of the previous thirty years. I use the term "long-term average" to mean the average back to 1853. The term "since records began" is often used without a clear date reference, which can create considerable confusion. Most meteorologists use the mean daily temperature as the basis, but many sources only quote the daily maximum and so I have used that figure throughout.

2012 was the third exceptional year in a row. It had the highest March temperature since 1853. The thirty year average for March, the normal definition of climate, reached 14.03°C a figure last seen in 1961. Annual Rainfall was the highest recorded since 1853 at 1420mm. The previous record of 1253mm set in 1882 was then thought to be the highest in 150 years (Horton West country weather book). And it was the wettest April and the wettest summer since 1853.

Year	2003	4	5	6	7	8	9	10	11	2012
Av. Max °C	15	14.3	14.4	14.7	14.5	13.7	14.6	14.2	15.5	14.7
Ten year av. °C	14.2	14.2	14.2	14.4	14.4	14.3	14.3	14.3	14.4	14.5
Rainfall mm	758	945	896	952	1107	1150	986	747	847	1420
Ten year av. mm	963	954	956	974	997	1005	993	943	945	981

Table 1 Average mean maximum temperature and rainfall. The second row is the average for the ten years up to and including the year referred to.

Seasons.

The average for the **winter** (December. 2011 to February. 2012.) was 9.1°C, back to a more normal level after three cold winters. Rainfall, at 77mm a month, was just below average. There were 30 frost nights (October to April), the last on April 16th. A cold snap From January 30th to February 13th saw 14 days of ice on ponds, and 2 days of snow.

Spring (March to May) Average temperature was 15.3°C, two degrees above average, largely caused by the warmest March since1853. Rainfall at 84mm a month was 50% above the long term average.

Summer (June to August.) Average temperature was at 19.6°C, a little lower than average and rainfall a record 149 mm per month, the highest recorded since 1853, double the long term average. June had a record of 187mm, triple the normal and was the wettest month of the year. This was the fifth summer in a row with above average rain fall.

Autumn (September to November.) Average temperature at 14.3°C was normal, Rain fall was 50% above average, and November with 178mm was double its normal figure. On Sept. 24th 72mm fell, the wettest Bristol day since July 11th 1968.

Seasonal Comparisons To put the 2012 seasonal average temperatures into perspective, Table 2 shows the seasonal temperature extremes, with their year, the average since 1853, and the difference between 2012 and the long term average.

	2012	Min	Max	Avg. since 1853	Diff.
Winter	9.0°	1917 2.5	1920 10.6	7.5°	1.5°
Spring	15.3°	1887 10.4	1893 16.6	13.0°	2.3°
Summer	20.3°	1883 18.0	1976 23.9	20.2°	-0.6°
Autumn	14.3°	1915 10.6	1959 16.8	14.0°	0.3°
Annual	14.7°	1892 12.1	1921 15.6	13.7°	1.0°

Table 2 2012 seasonal average temperature compared with minimum, maximum and average since 1853.

	2012	Min	Max	Avg. since 1853	Diff
Winter	74	1964 21	1995 154	79	-5
Spring	88	1893 17	1981 107	60	28
Summer	149	1995 11	2012-149	74	75
Autumn	139	1978 26	1935 173	87	52
Annual	118	1864 49	2012 118	75	43

Table 3 Average monthly rainfall in mm for each season in 2012 showing the maximum, minimum and average since 1853, and the difference between 2012 and the average since 1853.

Monthly percentage deviation in 2012 from the average since 1853.

Temperature January and March were warmer, the rest close to the long term average**.** R**ainfall** February and March were dry, the rest of the year very wet,

	Temp	Rain			Temp	Rain
Jan	26	-6		Jul	0	49
Feb	10	-56		Aug	6	79
Mar	49	-53		Sep	2	42
Apr	1	174		Oct	0	35
May	12	31		Nov	3	105
Jun	-4	206		Dec	-2	110

Table 4 Monthly percentage deviations in 2012 from the long term average

Monthly Summary 2012

J	F	M	A	M	J	J	A	S	O	N	D	Av.
9.1	8.2	14.9	12.6	18.3	18.6	18.6	21.5	18.3	14.1	10.5	8.8	14.7
79	27	28	156	81	187	107	152	112	128	178	185	119

Table 4 2012 Monthly average temperatures and total rainfall

January The first two weeks were warm with westerly winds round high pressure in Spain. Jan. 13th-17th was cold with frosts, light east winds and high pressure. This was replaced for a week by warm westerlies. On 26th temperatures fell sharply and snow fell briefly on 30th.

February The first two weeks saw frosts, ice on ponds and reservoirs, and largely easterly winds driven by a Baltic high. The second two weeks were warmer with westerly winds round high pressure in Europe, and were almost completely dry.

March Warm south westerly winds dominated for the first three weeks, and then switched to the east and temperatures soared to 23°C from 24th-28th. It remained dry, and drought orders were made. Sunshine hours were 50% above normal.

April Winds switched to the north from the start of the month and remained from that direction throughout. Temperatures stayed around the normal of about 13°C. The long dry spell was broken from 19th when low pressure too control and the last two weeks were on the whole dull, cold and wet. Migration was seriously held up.

May. Began with northerly winds, and rain for the first week, but the wind switched to SW on 6th and a huge flood of hirundine migration poured through the area. Temperatures rose above 15°C and the rain ceased for the rest of the month. On 21st temperatures rose abruptly to 21°C and reached 29°C on 25th, 26th, which was to be almost the highest temperature of the year.

June. Dominated by low pressure systems, SW winds and rain and a maximum of 25°C on 28th. Only eight days were without sunshine, but only three days had over ten hours. It proved to be the wettest June since 1853.

July Temperatures only reached 20°C on five days in the first three weeks during which it rained almost daily, and winds were mostly from the NW, but from 21st the sun came out and temperatures picked up to 30°C on 25th and 26th as high pressure took over.

August A dull month, temperatures consistently around 20°C, little sunshine, winds in the south and regular out breaks of fairly heavy rain.

September. Began fine and warm with high pressure but temperatures fell below 20°C on 11th and were down to 14°C on 26th. The first three weeks were almost dry and then on 24th 72mm fell, creating widespread flooding especially of the Somerset levels.

October. Began with the temperature at 18°C, and fell below 10°C on 26th. A month's rain fell between 3rd and 8th, though there was little more for the rest of the month. NE winds set in on 22nd and the first frost came on 27th.

November. Temperatures were around 10°C throughout, but there were only three frosts. There was heavy rain on the first four days and from 20th to 26th. Winds shifted to the North on 23rd and temperatures fell to 5°C on 30th with frost and ice on ponds.

December. For the first two weeks temperatures were low, the wind in the North and there were eight frost nights. On 14th the wind switched to the west, and temperatures rose to 11°C. The last two weeks saw over 150mm of rain, and it was the wettest December since 1965.

Weather Extremes.

The table below gives figures for extreme annual events over the past decade, enabling the extreme events of 2012 to be put into perspective. There seems to be no pattern in these figures, except for the number of days without any sun to increase from around 70 to around 100. It is also interesting that, contrary to common perception, two days in every three have no rain at all.

		3	4	5	6	7	8	9	10	11	12
Hottest day	°C	32	28	30	35	27	28	28	26	29	30
Coldest day	°C	1	3	0	0	2	2	-1	-5	1	1
Wettest day	mm	45	45	47	39	40	35	36	36	40	72
Sunniest day	hr	15.1	13.9	14.8	14.7	14.1	14.9	14.7	15.6	14.7	15
Longest dry	days			14	22	24	16	20	24	23	17
Longest wet	days			7	11	8	8	8	7	5	15
Frost, nights	days	49	30	32	33	25	44	42	76	22	41
Snow cover	days	0	6	2	2	2	1	19	33	0	1
Storms	days			1	3	6	4	1	1	1	1
> 25°C	days	22	13	14	27	1	7	5	3	14	19
< 5°C	days	25	15	26	39	18	14	37	60	13	16
>10hr sun	days	42	19	38	36	45	29	49	46	44	38
No sun	days	56	90	89	107	99	95	95	106	104	93
No Rain	days	263	231	248	234	238	228	265	269	253	205

Lynmouth Road Allotments – wildlife and cultivation in harmony.

Harry McPhilamy

Lynmouth Road Allotments are a small group of allotments nestling between Lynmouth Road in St Werburgh's, Bristol and the Severn Beach railway line embankment. They have been worked as allotments continuously since 1979 and off and on since WW1. Since we started recording the wildlife observed on the allotments over 15 years ago we have been struck by the range of fauna there. The habitat is a sheltered, south-facing slope which can create a warmer microclimate attractive to insects, including butterflies and moths. The land, with calcareous soil, has always been open space so biodiversity has had a chance to build up. It adjoins the wildlife-rich area of Narroways Nature Area and the neighbouring allotments also provide further local habitat. The allotments are connected by the wildlife corridor of Narroways and Boiling Wells Valley to Purdown, Stoke Park and the open countryside beyond. There is a great diversity of habitat, as well as the cultivated allotments (in various states of management!). This includes adjoining scrub, hedgerows, and the embankment with grassland and woodland. There are also several ponds on the plots, and a few beehives. Several Plotholders feed the birds with bird feeders and there are some nesting boxes in nearby trees. Most of the plots are managed organically.

In summer the warmth brings out the reptiles and amphibians. Slow worms are seen in compost bins, and under matting – up to six at a time. Frogs can be seen in ponds and long grass. Smooth Newts appear in numbers in local ponds. Common Lizards are often seen, basking in the sun in spring. Toads, sometimes loiter in damp corners.

Birds are often the most visible wildlife. Blackcaps sing from the Elder trees, and Chiffchaffs can also be heard calling – one of the early signs of spring. Even Willow Warbler pass through on migration. Grey Wagtails fly over from the nearby stream, Song Thrushes sing and several Jays live here, sometimes perching on beanpoles. Goldfinches regularly feed on teasels and a dozen or so House Sparrows live in scrub behind allotment. Frequent Long-tailed Ttit parties pass through and other birds seen include Greenfinch, Goldcrest and Coal Tit. Sparrowhawks hunt round here and in winter Redwings, Fieldfares and even Waxwings have been seen.

Honeybees live in the beehives on the allotments and the bees pollinate the fruit trees and other plants in the area. The nettle patch, Garlic Mustard and Hop plants support the larvae of Red Admiral, Small Tortoiseshell, Peacock, Orange Tip and Comma butterflies. Sometimes Painted Lady, Holly Blue, Brimstone, Ringlet, Gatekeeper, Speckled Wood even grassland species like Common Blue and Marbled White occur. Rose Chafer beetles are often seen in Cardoon and Teasel flowers in July and the ponds support Red and Blue Damselfly species, and dragonflies such as the Common Darter. Scarlet Tiger Moths have a colony here and appear in numbers in June. There are also Red Underwing moths and even Hornets are occasionally seen.

A family of foxes live in embankment behind the plots and there is evidence of Badgers in the locality (unfortunately they seem partial to sweet corn!). Bank Vole, Field Vole and Wood Mouse occur, as do Pipistrelle bats.

These allotments are privately owned and under threat of development. It is not just the allotment holders who would lose their valued sanctuary. More information is available on the website at http://www.lynmouthrdallotments.org

The design history of dinosaurs indicates that aves are bipedal to avoid having to synchronise fore and hind limbs at speed; flight came later.

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An often overlooked feature of birds is that they are bi-pedal. To labour the point; the centre of gravity is balanced some height above the ground on two stilts; the slightest pitching requires instant correction. This may not seem too impressive for a Sparrow, where the feet are relatively wide and errors never catastrophic, but it is something remarkable for Ostriches, Moas, Cassowaries, Emus, Elephant Birds and Rheas. Only one small group of mammals has achieved bipedal posture control, and that only recently. Amongst the others Mongooses and Bears alone rear up with any confidence, but then hesitate to walk.

The first chordates on to land, newt-like amphibians, possessed fish propulsion, in which a 'contract' command is passed from segment to segment, in the form of a bucket brigade delay line (1). The commands originate at the head end, presumably triggered by an oscillator on the left side and its anti-phase on the right. The segmental division of the muscle mass localises the influence of each momentary contraction and so generates a smooth wave along the body. It is uncertain whether the rate of transmission is pre-set, or if each segment starts contracting when its predecessor has reached, say, ten percent contraction. If the second the rate of transmission would be determined by the viscosity of the surrounding water and this could be verified experimentally. Newly-landed fish flap about wildly in low viscosity air.

The limbs of simple amphibians act as pegs to achieve purchase on the terrestrial surroundings; in time they developed into articulated limbs, and the old swimming movement became their sequence of movement. Swimming - pushing water backwards - requires a wave travelling down the body, whereas limb coordination involves the body bent first left, then right. This is in fact the same thing, but with all segments contracted at once. It is a great deal easier to lever the bodyweight over obstacles by climbing one limb at a time. It so happens that the sinusoid coordination did indeed apply one limb at a time. However repeated squeezing and extending the body uses up energy, possibly more than required to propel the body weight forwards, and crawling must be very tiring. An upright stance permits the whole limb to be applied to obstacles, larger rocks may be traversed by smaller animals, but denies the use of sinusoidal coordination.

For a four-wheel drive vehicle, travelling in a straight line, it is imperative that all four wheels rotate at the same speed, otherwise there is wheel-slip, and needless wear of the tyres. Quadrupedal animals are also 4x4 vehicles, and all four limbs must propel the load at the same speed. But also limbs must maintain the chosen phase sequence, otherwise the animal topples over. To retain phase margin over several strides the fore must keep the same stride length as the hind, even though the geometry of the limbs differ.

For a sprawling Salamander the axis of the stride is, as it were, a pin vertically through the pectoral and another through the pelvic girdle. Sideways sinusoids of the trunk provide the correct limb phase and speed by simple mechanics. An erect stance extends the stride, but the axis is a pin now horizontally through each girdle. Sideways movement of the trunk cannot possibly transmit coordination prompts, and bending is in the wrong direction.

Vertical flexion (bunny hopping) coordinates front and hind but, as we shall see, works for small animals alone. Early reptiles, newly erect, came to this problem of speed and phase coordination with no neural controls in place. They had no way of implementing the desired control. The Archosaur solution was to go from four wheels to two, skipping the entire crisis. Bipedal walking and running demands only one limb to be in anti-phase with its neighbour, plus some starting and parking programme. The oscillator could be at the head end, as before, and the signal disabled for all but the pelvic segments.

A bipedal Archosaur in motion avoids pitching forward by having the counter-clockwise turning moment of the torso balance by a clockwise turning moment of the tail. Hind limb coordination may be neural, but the attendant posture control is mechanical. This has a cost. Suppose the body forward of the pelvis, the active metabolic part of the beast, weighs one ton. The counterpoise tail must be a similar weight. So in motion each leg supports two tons alternately. By contrast a cow of one metabolic ton trots on four legs, so each hoof only supports half a ton, one quarter the load.

With this excess cost there should be every demand for neural control of posture. Perfect control responses are instantaneous, of exactly the correct magnitude, and yet never overshoot. This is a tall order, and can be realised only a little at a time. There must be halfway designs which nevertheless work well enough to sustain a competitive animal. Suppose part of the weighty tail were replaced by a fan of feathers. Its aerodynamic drag would slow the pitching errors and allow the grace for a slower posture control to respond. Tail feathers would also damp erratic overshoots. Any fan is always going to be more effective damper for small animals for whom the air is relatively more viscous, but it is never going to be any use to T Rex, and indeed Archaeopteryx was the size of the smaller dinosaurs.

In addition the femur of birds has become bound to the body wall so moving forward the pivot of the legs. This partly retains the moment cancellation of dinosaurs, though becoming more efficient because the body both before and behind the fulcrum contributes to metabolism, however it is obviously unbalanced and neural control will be required to make up the difference.

Pursuing this idea, aves are bipedal to enable locomotion, not because the forelimbs have been co-opted into wings, so there is no reason to suppose that all the ratites, flightless birds, once flew. Their large cerebellum is to cope with walking on two legs without a tail, although it must have come in handy for flight control later. Emus are relict dinosaurs, retaining the dinosaur habit; the fossil *Hesperornis* is an aquatic version. Aliferous birds by contrast are dinosaurs that have moved on, flying, singing and what have you. This interpretation was first advanced by TH Huxley and has been ridiculed ever since.

In flight a large feathered tail applies drag behind the centre of gravity, keeping the bird pointing forward in the manner of a Chinese kite. Later fossil birds (*Confucinsornis, Changchengornis and Jibeinia*) are shown (2) with tail streamers which also would apply tail drag but lack the weight to encumber flight or the strength to contribute to posture control, indicating that posture control was by then mastered, but unstable flight control (3) was still under development. Of the other flying reptiles, the Pterosaurs, only the small *Rhamphorhynchus* is supplied with a tail streamer. The development of flight control in Pterosaurs and Bats looks to have taken a different path

The cost of design for speed with dinosaurs is having to endure a counterpoise tail. Mammals have achieved speed but retained all four legs supportive, but usually just the hind are propulsive.

Modern quadrupedal mammals (start with horses) demonstrate *independent neural* control of each limb. The body is essentially rigid, so control is entirely neural. The phase relations of the limbs can be altered from a walk, to a trop, to a canter, to a gallop, so the limbs are controlled independently.

Amongst the mammal-like reptiles the skeletal evidence of an erect stance is first seen in the Cynodonts (4). Reconstructions show active carnivores with no difficulty of locomotion, which implies they came pre-adapted to walking erect, with the neural controls already in place. Their predecessors were Pelycosaurs, dangerous tigers of their time, but skeletons show their limbs to be sprawling. Sinosoidal coordination works for small lizards, but as species become larger, the better to eat the smaller, there will be scaling problems. The force exerted by any muscle is proportional to its cross-sectional area, which in turn is proportional to the length of the animal squared. The muscles of interest are those of the body wall pulling together the ribs in order to coordinate the limbs. The volume of the body, which necessarily becomes compressed, is proportional to the length of the animal cubed, so as the tiger becomes a larger it becomes proportionally weaker. Here is sufficient incentive to develop a neural control system gradually to replace mechanical coordination; as it becomes little by little more competent, each improvement allows succeeding Pelycosaur species to become a little larger, even though all the time they retained the sprawling stance. The same scaling problem applies to bunny hopping (above) though real rabbits don't have limbs bound to the body wall.

The limbs are at opposite ends of the animal so animal-wide coordination is essential. Consider a Cheetah, admittedly an extreme mammal. It has a body length (BL) pelvic to pectoral, and travels at 45 mph = 20 ms^{-1} Myelinated somatic nerve may conduct signals at 100 ms^{-1} so the transmission delay over the body length is BL/100s. In this time the Cheetah travels 20xBL/100m.

A galloping animal covers approximately two body length per stride, so during the transmission delay the Cheetah covers (20xBL)/(100x2XBL)=1/10th of a stride. Additionally nerves have a refractory period of 4ms during which a Cheetah will cover a further 1/35th of a stride. Evidently control of the hind limbs cannot originate anywhere near the fore limbs.

Whereas arthropods are entirely rigid (a dead beetle is indistinguishable from the living one) and their control loops are very short (5), chordates have developed progressively looser bodies. Dead fish, picture a mackerel on a fish mongers slab, are solid and lifelike, but a dead mammal is slumped on the ground, head limp, limbs askew. The morphology of advanced chordates is malleable, but sustained muscle action is essential to retain the living form. The layout (algorithm) for the control of locomotion and posture is surely as complex as the structure we see controlled. With industrial controls we see Boolean logic, coded signals, tree geometry, nested patterns, sub-assemblies and all responses run parallel until a microprocessor becomes involved, which, like a Turing machine, works only series. For all the work done on cybernetics, the accounts of how the coordination of quadrepedal animals is laid out feature none of this, and are mostly trivial and disappointing.

Apart from early mammals, modern quadrupedal reptiles have also developed more effective gaits. Prof Benton (6) reports four terrestrial gaits in extant Crocodiles. 1 Tobogganing; 2 Sprawling like an amphibian; 3 High walk in which the limbs are tucked well under the body; and 4 Galloping in which the fore and hind limbs act in pairs. If Crocodiles can do this, quadrupedal Dinosaurs may have done the same, and it is remarkable that the overloaded bipedal Dinosaurs remained successful until the K-T boundary.

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Phoenix Hedge, Henleaze

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Summary
The venerable history of this relic hedge is considered together with its value as an important habitat for wildlife in a very built up area. An estimate of its age using Hooper's hypothesis indicates that a hedge has existed on this site for some centuries. The current and future management of this hedge should be related to its importance as an amenity feature of significance to an increasingly urbanised population detached from the natural environment.

Ancient history
Imagine, if you will, an area of South Gloucestershire in 1881 (sheet LXX1) This agricultural landscape consisted of many small fields, criss-crossed by footpaths, rights of way and "easements of way" and dissected by a narrow lane. To the South of this there were several large estates and on the north the land rose to the highest point in the district called Golden Hill.

When Bristol's merchants, newly wealthy on trade in sugar and tobacco, aspired to owning a country estate they bought one of the small farmhouses, demolished it and built a mansion on the site. The surrounding land was not farmed as it had been previously but turned into formal gardens with grottoes, small woodlands and extensive kitchen gardens and greenhouses. It was customary to keep a few cows and chickens to supply the household.

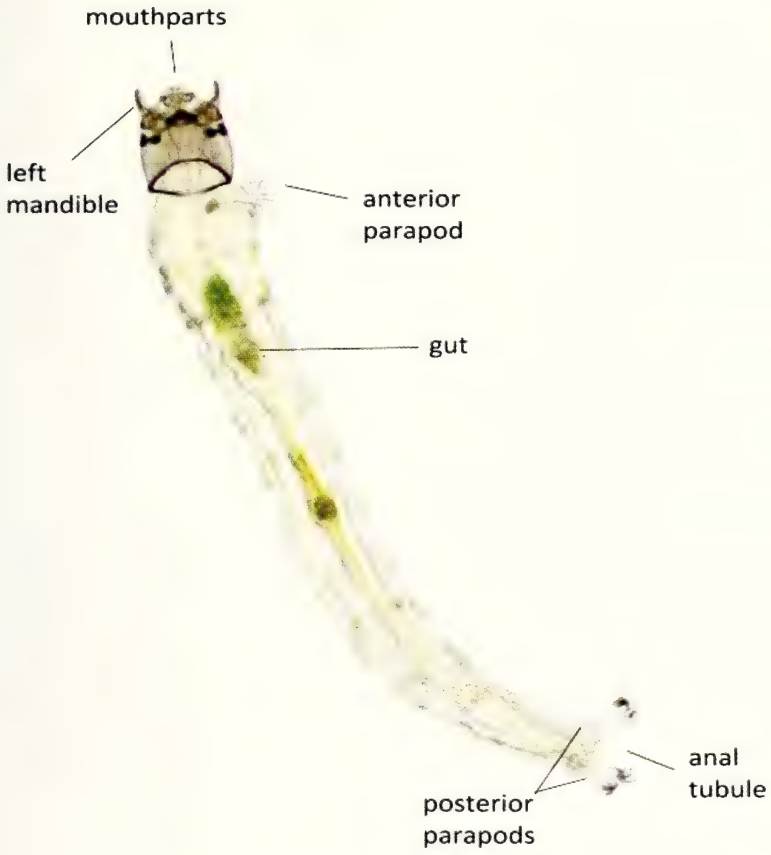
An elderly resident living on the high ground walked to school at Bishop Road in the 30's and always made a detour to talk to the cows in the pastures belonging to Claremont.

1 Stroud Valley railway, see page 9

2 Bristol Docks railway, see page 16

3 Severn Tunnel from Cattybrook brickworks, see page 24

4 Chironimid eggs, see page 92



5 Chironimid larvae, see page 92

6 Volvox, see page 92

7 Erosion in the Gully, November 2012

8 Red Oak, the Promenade Clifton

9 Pampas Grass, the Gully

10 Twiggy Mullein, St Vincent's Rocks

11 Ragged Robin, R Muston

Helophilus trivittatus

12 By Tony Cottrell

Cheilosia bergenstammi

13 By Tony Cottrell

14 Fungus on Sycamore leaf 2012

15 Japanese Maple Westonbirt

This was built by the chocolate magnate Caleb Bruce-Cole and was the home until the 1950's of his wealthy widow, a far- sighted lady who planted a wild flower meadow as well as her formal gardens. The house is now a special needs school and Henleaze Infant and Junior schools have been built in what was once the cows' pasture.

Keeping the cows within their own pasture and preventing them from straying onto the footpaths required solid barriers which in those days meant a hedge. To keep a hedge stock proof required the attention of a skilled labour force to annually prune it, keep it free from bramble and once every 10 or 15 years to lay it properly. As the estates were broken up for development features such as hedges were too expensive to maintain and were mostly grubbed out and replaced by walls and fences. These are not good habitats for wildlife compared to the wonderful corridors of mixed species occurring in an old hedge but by a miracle one of these hedges has survived – it is known as Phoenix Hedge.

Location

The hedge in question lies on the boundary of the school playing field and alongside a well used footpath once labelled as 'Access to the countryside'. Parish boundaries, which were originally established by the Anglo-Saxons in c800 AD normally followed such field boundaries, marking turning points with boundary stones and the 1881 Ordnance Survey map of the area shows boundary stones at either end of the hedge. It features on the Bristol map (visit http://maps..bristol.gov.uk/knowyourplace) and has a website at www.sites.google.com/site/phoenixhedge where the latest sightings of wildlife are recorded.

Its situation has led to a strange situation regarding ownership. The land on which the hedge lies is not part of the school estate and, although it borders a footpath, which the council is responsible for, successive councils have refused responsibility for maintaining the hedge. By the 1980's this once well managed hedge had become a straggling line of hedge plants choked with bramble with large trees overarching the path and cutting out light.

It was nevertheless a superb habitat for wildlife. It was well known for early sightings of Small Tortoiseshell with Speckled Wood, Red Admiral, Commas and Peacocks in season.

In 1987 it featured on a map exhibited at the Natural History Museum for a competition The Wild Side of Town where people highlighted on maps the often small wildlife sites that they knew. When it was realised that this hedge contained so many native woody species that it must be very old Max Hooper's rule for approximating the age of ancient hedges was researched. A species count was made and an estimate of its age determined.

Establishing the age of an old hedge

The Hooper method depends on counting the number of woody species in several 30m samples in the hedge and applying the formula that the mean number of woody species gives the age in centuries with in a limit either way of 200 years. Phoenix hedge is only 90 m long and has been badly damaged in about one third of its length and so there are not enough truly valid samples for vigorous statistical analysis. Nevertheless the number of native species present is impressive and its construction indicates an ancient structure.

Species present

Hawthorn *Cratoegus* spp

Mostly Common (*Cratoegus monogyna*) with some hybridisation with Midland (*C. laevigata*) which is present on the Downs. This is the plant of choice for hedges as it grows well after laying, tolerates annual pruning to keep it shapely and is an excellent species for wildlife. It seems not to sucker readily and is difficult to propagate from seed but cuttings strike.

Blackthorn *Prunus spinosa*

The flowers and fruit of this plant suggest that it may be a hybrid with the domestic plum, *Prunus domestica*. It responds to laying but is very vigorous and suckers rather too well. The management team have culled suckers outside the line of the hedge and prevented it overcoming the hawthorn.

Ash *Fraxinus excelsior*

A few standard trees are often left in a hedge for shade and timber and one of the Ash trees shows signs of being laid in the distant past. It is now badly shaped and in need of a tree surgeon's attention.

Field Maple *Acer campestre*

When the hedge was laid in 1994 an enormous bole was uncovered within the hedge line. Exposed to light this produced healthy shoots identified as Field Maple but it was fatally damaged when a gate was installed. However a smaller bole further along the hedge in dense shade was also found and this has grown shoots too. The young foliage prefers shade. Whether this also was a dormant bole or a sucker from the first is not clear. Historically, Field Maple generally only occurs in hedges about 400 years old

English Elm ***Ulmus procera***
The hedger managed to "lay" some Elm trunks in 1995 and these survive well. There are also standard trees which may just be reaching the age and height (10 to 15 years and about 3m tall) at which they are susceptible to attack by Dutch Elm Disease. If so these will be lost but the Elm rootstock is enormous and vigorous and will produce new suckers. These Elms flower and produce prodigious amounts of seed none of which is viable so regeneration depends on suckers.

Holly ***Ilex aquifolium***
This became a standard tree within the hedge line but was damaged by building works. Seedlings from a tree a short distance away can be used to replace this.

Dog Rose ***Rosa canina***
Similarly the Dog Rose persists in the hedge in a rather straggly form. It has spread into the school field and has made a hedge all round the houses that were built there providing plenty of material for replacement whips. Although not a very woody species this is usually included in the list of plants used for dating hedges.

Spindle ***Euonymus europaeus***
During the laying in 1995 the great extent of Spindle which was known to be present was seen. The main trunk was the largest the hedger had ever seen suggesting that it has been in the hedge a long time. Spindle is not usually found in hedges less than 600 years old, needing perhaps a particular mix of soil, shelter and adjacent species. Although poisonous in all its parts birds eat the fleshy seeds and the leaves are well chewed by September. It is difficult (may be impossible) to propagate from seed but will strike from cuttings.

Dogwood Thelycrania sanguinea (Cornus sanguinea) and Elder Sambucus nigra
Neither of these semi woody species are the hedgers choice as the stems are too flimsy for laying yet both occur in hedges and some scientists use them for dating.. The berries are abundant in the Autumn and attract birds and probably small mammals.

Bramble *Rubus fruticosus*
An ubiquitous plant in any old hedge but it very soon makes an impenetrable thicket and smothers the true hedge plants. All of it was removed in 1994/5 and again in 2010 when several dumpy bags and green bins were filled with stolons. Assiduous chopping of young growth by the management team has kept it well under control since the laying in 2011.

Establishing the age of the hedge
Assuming the length of the hedge provides three samples, the average is eight woody species in each 30m, suggesting an age of 800 years. The 1840 Tithe map shows a field boundary at this location which undoubtedly followed the line of the hedge. As a species rich hedge it certainly precedes the Enclosures, 1750-1860, when many new hedges were created, mostly planted with hawthorn. The significant amount of Spindle within the hedgerow is also indicative of it being an ancient hedge. And the fact that it is a parish boundary suggests that it existed when the parish was created.

More than 800 years ago farmers created hedges by the mound and ditch method. Stones removed from the cultivated fields were added to a mound created from the ditch. A fence of sticks or whips of hawthorn were often planted and soon formed a stock-proof hedge. At the West end of Phoenix Hedge there is clear evidence of this as the hedge grows on a stony mound beside a ditch (now partially filled in). A local historian has also found evidence of a Saxon meeting place in the school field.

Recent history

For ten years after the map was exhibited in 1987 I tried and failed to arouse some interest in the hedge as a valuable historic site with great wildlife value. The tutor from a hedging course run in Somerset who was a judge of championship hedge laying competitions examined the hedge and thought it well worth conserving but even his valued opinion carried no weight with the local amenity society nor with the many Council officials from various departments who were contacted. By a lucky chance one of the many pleading letters landed on the desk of an official in the then Avon County Council who was keen on both wildlife and crafts such as hedge-laying. Through her good offices Avon County Council admitted ownership and agreed to finance laying the hedge professionally. This was no mean task given the neglect of years and so to give the wildlife a chance to relocate it was done in two sections, a year apart, in 1995 and 1996.

Although it looked a drastic not to say brutal treatment at first the rejuvenation of the hedge plants was spectacular in the spring following each laying in February. There were still problems which did not help the growth of the hedge. The school planted a line of *Cupressus leylandii* along the hedge in the school field in a misguided attempt to give privacy to the children. As these trees were never managed they grew into a very tall line of trunks with a high crown which certainly did not give privacy and took a great deal of light, moisture and nutrient from the hedge.

Part of the hedge was sadly removed during development of two new houses on the site of the old school kitchens. A gate from the school field to the footpath breached the oldest part of the hedge and was sited on the mound at its most hazardous steep slope. Most of all it was not possible to keep the new hedge clear of bramble and to prune it annually so that by 2009 when it needed laying again it was in a sorry state.

At this point neighbours with experience of hedging and others living near the hedge took an interest in it, organised working parties of guerrilla gardeners, and eventually became a formal group, the Phoenix Hedge Preservation Group in 2011, with the intention of conserving and promoting this unique feature. A local resident and the BNS supported the Group with donations and what was even more important with recognition of the value of this hedge and the endeavours of the Group to preserve it properly.

A successful bid to the local Neighbourhood Partnership in February 2011 eventually resulted in the Council organising laying of the hedge. The chair of the Group worked assiduously to establish ownership (and thereby responsibility for upkeep) which has proved difficult. However Bristol City Council has assumed responsibility for one metre of the verge alongside the footpath. The rest has been kept clear of bramble and the worst thistles by the Group's monthly working parties. Formal acknowledgement of this role in maintenance of the hedge and its environs has been sought from the Council.

Gaps in the hedgerow have been filled with whips of local provenance. Some of these, donated to the Junior School, were potted up and cared for by the school's Gardening Group who planted them in the hedge in April 2012 and these are now growing well. An award from Wessex Water's Watermark Fund and another successful bid to the Neighbourhood Partnership Well Being Fund enabled us to install an interpretation board in April 2013 to inform those who pass along the footpath about the hedge's history and wildlife and raise awareness of the hedge's unique value.

The Future

To quote a recent Times article. "City wildlife matters in a different way to country wildlife. There are more people to need it, love it, and nurture it. Wild places matter to people: the wild places on our doorstep as well as the wild places we travel to. Such places complete us."

How true this is of the last little wild place in a very crowded part of Bristol. Those who walk the footpath daily with small children delight in the first Dandelion and the Bumblebees on White Dead-nettle, the elderly couple say they are taken back to the countryside of their youth, and the schoolchildren can use it as an outdoor class room.

It could, or should, be a wildlife reserve, the smallest in the region perhaps. In the meantime the Group is looking at ways to afford it better protection and safeguard its future. To spread the hedge's genome saplings raised from its component plants could be planted in out of the way locations such as on the boundaries of the sports fields, maybe with wildflowers too. This would be a scattered patchwork of a nature reserve but one giving pleasure to humans as well as good habitat for wildlife. Maybe that will be the only way to preserve our wildlife inheritance in the future.

BRISTOL & DISTRICT INVERTEBRATE REPORT, 2012

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INTRODUCTION

2012, what will it be remembered for? Freak weather that saw a drought in the first quarter followed by rainfall levels that made it one of the wettest years on record? Or a year that typified the dramatic swings in weather that climate change has brought with it in practice? Whichever, in entomological terms it will remain an exceptionally poor one.

Looking back over previous invertebrate, and , prior to that, entomology reports, in this publication, most years seem to have been described as not particularly good. Perhaps entomologists look back with rose-tinted spectacles on years in their youth when everywhere seemed to be teeming with insect life or perhaps we have been truly witness to a gradual (sometimes dramatic) reduction in both biodiversity and abundance?

The report issued by Butterfly Conservation (BC) early in 2013 on 'The State of Britain's Larger Moths' makes grim reading. It is not just the loss of habitat specialist species but the decline of once common species which raises alarm. On average in southern Britain the data suggests a decline of 40% in abundance over a 40 year study period. This type of reduction is no doubt echoed in other insect groups but for which sufficient study data is unavailable. Certainly in the Bristol region in 2012, numbers of common insects such as the grass bugs *Stenodema laevigatum*, *Stenotus binotatus* and *Leptopterna dolobrata* all seemed very low.

As key members of food webs, low numbers of such species must have an impact on other more popular groups for study, such as birds. More grim reading can also be found the BC report on butterfly numbers nationally in 2012. This suggests many species saw declines in number of over 50% on previous years. Despite all this, on the positive side, BNS member Michelle Fowler was able to comment on the large number of Rose

Chafers and Speckled and Dark Bush-crickets in her garden during this year, so at least some species seemed to be coping. Also Sand Point remains one of the better butterfly locations in the region with Wall Brown and the introduced Glanville Fritillary population both holding their own and significantly one report of Grayling butterfly, now a great rarity locally.

In addition to depressed numbers for many of our endemic species, 2012 was also a very poor year for immigration. Usually common migrants such as the Silver Y moth were few in number. There were no great influxes of butterflies, moths, hoverflies or dragonflies such as we have seen on occasion in recent years.

Aside from the doom and gloom, the sheer variety of invertebrate species and the need to actively seek them out has still meant that new and interesting records have occurred during 2012. In the Avon Gorge, members of staff from the Bristol Conservation and Science Foundation, based in Bristol Zoo, continued the annual monitoring of the Red Data Book, Silky Wave moth population. This fairly inconspicuous small white moth, easily disturbed by daytime, is only known from three sites in the British Isles, the other two in Wales. The Gorge seems to be the only site with a regimented scientific programme of monitoring and the results are therefore even more important. New habitat management in The Gully within the Avon Gorge, primarily to assist the rare flora, has been introduced in the form of a small flock of billy goats.

The impact of this grazing is being watched and recorded. So far moth numbers seem to be holding their own very well. The monitoring has shown a peak of emergence of the moth in early July, a peak which is easily missed by random sampling and so a key fact in terms of comparing year on year data.

Another rare moth species, the Narrow-bordered Bee Hawk, continued to appear at its site south of Bristol, this year on the wing from 25th May as witnessed by Nigel Milbourne. Species which still seem to be on the increase locally include the once rare hoverfly,

Rhingia rostrata, the Scarlet Tiger moth, Small Ranunculus moth and Dotted Beefly. As always, each year there are one or two species of insect found which are new to the region, as listed in the species account below.

It is always satisfying when you set yourself a target and actually achieve it. There have been previous records of the Purse-web Spider from the Avon Gorge in the past, but no reports for several decades. Britain's only representative of the mygalomorphs (the bird-eating spiders of the tropics), the Purse-web spins a tube of silk on the soil surface perhaps as long as 8cm which then passes under the soil for as much as a further 50cm in some cases, in which it lives. Insects landing on the exposed silk are stabbed from within by the spider's jaws and the prey then dragged through into the silken tube to be consumed. Never having seen the species before, Andy Pym, Mark Pajak and myself set out to try and find the spider at the end of the summer of 2012. After much searching a silken tube was found and although no living spider was seen, inside the tube was the shed skin of this species. The target in 2013 is to see the living creature.

One important new publication during 2012 was a *Field Guide to Micro Moths of Great Britain and Ireland* by Sterling, Parsons and Lewington. This is the most comprehensive attempt ever to creating a single, easy to use, volume on the micro moths and it is bound to result in a considerable increase in recording of this group of insects. New volumes of the *New Naturalist* series on plant galls and grasshoppers and crickets also published in 2012 may again stimulate new interest.

Corrections to the 2011 report –

My apologies for the following errors that crept in to last year's report.

Page 62: *Aphelia viburnana* – this record ascribed to Paul Chapman should have been credited to Paul Bowyer.

Page 63: L-album Wainscot *Mythimna l-album* – Bob Fleetwood's record was from his Clevedon garden (ST47), **not** from Weston-super-Mare, and was on 27 September 2011.

Furthermore, I have also heard of out of season records from 2011 not included in that report, namely Hebrew Character and Chinese Character moths on the wing on 30th and 3st October of that year, in Weston-super-Mare, as seen by Paul Bowyer.

Scientific nomenclature follows that used by the National Biodiversity Network website (www.nbn.org.uk).

My thanks to all who have submitted records directly to the Society (particularly to Jon Mortin, Andy Pym, John Martin, Nigel Milbourne, Bob Fleetwood, Michelle Fowler, Jean Oliver, Dave Nevitt, Chris Iles, Darrel Watts, Tony Smith, Tony Cotterell, John Burton, Marcus Rhodes, the Bristol Regional Environmental Records Centre (BRERC), members of the Clevedon Moth Group, Bristol & District Moth Group and the Bristol Wildlife E-group.

The importance of receiving, not just the records picked out here, but those of perhaps less noteworthy species cannot be understated in terms of monitoring the ever changing status of the invertebrate fauna.

Species of note in 2012

INSECTA
Psocoptera (booklice)
Valenzuela flavidus (Steph.) Poet's Walk, Clevedon (Cemetery), N. Somerset (vice county 6) ST393 708 14 October 2012 Jon Mortin. The only other records of this species held by BRERC are all from Steep Holm.

Hemiptera (true bugs)
Brassica Bug *Eurydema oleracea* (Linnaeus) The Tow Path below Leigh Woods, Avon Gorge, North Somerset (vice county 6) ST56 73 September 2012 Tony Cottrell. A recent colonist.

Reduvius personatus (L.) Newton St Loe, Bath & NE Somerset (vice county 6) ST71 65 18 July 2012 Darrel Watts. Recorded at this site previously but a relatively uncommon bug it seems.

Lepidoptera (butterflies)
Morpho ?peleides Kollar The Tow Path below Leigh Woods, Avon Gorge, North Somerset (vice county 6) ST56 73 30 May 2012 Tony Cottrell. Thought to be an escapee from Bristol Zoo.

Lepidoptera (micro-moths)
Bucculatrix thoracella (Thunb.) Farrington Gurney, Bath & NE Somerset (vice county 6) ST632 566 17 September 2012 Chris Iles. Leaf mines on lime. A very localised species in the region.

Coleophora asteris Mühlig Weston-super-Mare, North Somerset (vice county 6) ST3 6 20 August 2012 Paul Bowyer. Confirmed by genitalia preparation. The first record for the Bristol Region of this Nationally Scarce (Na) species whose larvae feed on Sea Aster.

Coleophora ochrea (Haw.) The Gully, Avon Gorge, Bristol (vice county 34) ST564 746 28 May 2012 Ray Barnett. Larval cases on rock-rose of this very localised moth across Britain, one of the Gorge's special species.

Elachista subocellea (Stephens) Claverton Down, Bath (vice county 6) ST7 6 26 June 2012 Richard Pooley. A Nationally Notable species (Nb) with the only previous records from the region being from the 19th C and a report of one in 2001.

Pandemis cinnamomeana (Treits.) Keynsham, Bath & N E Somerset (vice county 6) ST6 6 9 September 2012 John Aldridge. A local and uncommon species in the region.

Acleris cristana (D. & S.) Bishopston, Bristol (vice county 34) ST58 75 24 March 2012 Jean Oliver. A scarce species in our region although recorded from Bishopston previously.

Acleris literana (L.) Bishopston, Bristol (vice county 34) ST58 75 12 March 2012 Jean Oliver. A thinly distributed species locally which, as with the previous species, seems to be established in this part of the city.

Dioctria abietella (D. & S.) Dundry, Bristol (vice county 6) ST5 6 26 June 2012 Dave Nevitt. Very few previous records of this species associated with conifers.

Dioryctria sylvestrella (Ratz.) Tyntesfield NT Estate, North Somerset (vice county 6) ST50 71 11 August 2012 Paul Chapman *et al.* The first record for our region of this species.

Nephopterix angustella (Hb.) Keynsham, Bath & N E Somerset (vice county 6) ST6 6 9 September 2012 John Aldridge. A local and uncommon species in the region.

Stenoptilia zophodactylus (Dup.) The Gully, Avon Gorge, Bristol (vice county 34) ST564 746 13 June 2012 Ray Barnett. One swept, one of only two sites we know of for this species in the region.

Lepidoptera (macro-moths)

Currant Clearwing *Synanthedon tipuliformis* (Cl.) Keynsham, Nr Bristol (vice county 6) ST653 679 8 July 2012 Alan Bone. St Andrews Park, Bristol (vice county 34) ST592 751 14 July 12 Des Bowring. Not especially common so good to receive two new localities for this sometimes overlooked day-flying moth.

Chalk Carpet *Scotopteryx bipunctaria* (D. & S.) The Tow Path below Leigh Woods, Avon Gorge, North Somerset (vice county 6) ST56 73 16 July 2012 Tony Cottrell. A Nationally Notable species with a colony more usually noted from the Bristol side of the Avon Gorge.

Brussels Lace *Cleorodes lichenaria* (Hufn.) Dundry, Bristol (vice county 6) ST5 6 13 August 2012 Dave Nellis. A very local species in the Bristol region.

Poplar Hawk *Laothoe populi* (L.) Kingswood, South Gloucestershire (vice county 34) ST6 7 late September 2012 per Ted Poulson. Adult female brought in by cat (identified by genitalia preparation by Mike Bailey). Presumably a second generation example of this moth which is usually on the wing May to July.

Humming-bird Hawk *Macroglossum stellatarum* (L.) Oldland Common, Bristol (vice county 34) ST668 716 17 March 2012 Jack Willmott. Weston-super-Mare, North Somerset (vice county 6) ST3 6 1 April 2012 and 18 July 2012 Paul Bowyer. Very few records of this often common migrant during 2012.

Jersey Tiger *Euplagia quadripunctaria* (Poda) Abbots Leigh, North Somerset (vice county 6) ST5 7 26 August 2012 John Sparks. Elm Farm, Burnet, Bath & N E Somerset (vice county 6) ST6 6 22 August 2012 Richard Pooley. In the last few years the Jersey Tiger has moved out of its south Devon stronghold into parts of southern England and even established itself in London. Records from our region are still sporadic, such as these, and it will be interesting to see whether it becomes more of a feature of our local fauna.

Lead-coloured Drab *Orthosia populeti* (Fabr.) Pilning, South Gloucestershire (vice county 34) ST ST556 849 March 2012 John Martin. Blagdon, Bath & N E Somerset (vice county 6) ST5 5 29 March 2012 Nigel Milbourne. *Moths of the Bristol Region,* when published in 2008 had no recent records of this moth, although it can be easily confused with the Clouded Drab. It is intriguing to get more than one record in 2012 which could suggest recorders encouraging each other to look out for the moth, an overlooked native population or possible immigration?

Ni Moth *Trichoplusia ni* (Hb.) Dundry, Bristol (vice county 6) ST5 6 26 June 2012, Dave Nevitt. A rare immigrant but easily overlooked as a Silver Y, the second time recorded at this locality, other recorders should check their Silver Ys!

Buttoned Snout *Hypena rostralis* (Linnaeus) Burnett ST673 654, Stanton Prior ST684 629, Priston ST693 608, Kelston ST696 683, Carlingcott ST701 585, Withyditch ST704 593, Dunkerton ST707 595, Lower Swainswick ST762 675 Bath & NE Somerset (vice county 6) 11-27 July 2012 Mike Bailey & Martin Hunt. These records represent successful searches for the larvae of this moth (on its food-plant Hop) which has occasionally been recorded at light traps in the vicinity previously. It would seem to be a moth which is not especially attracted to light and this larval searching has shown it to be well established in this part of our region.

Coleoptera (beetles)
Ampedus balteatus (L.) Clarkencombe Wood, Ashton Court ST55 72 (vice county 6) 12 May 2012 Ray Barnett. One adult found in one of the ancient oaks at this important woodland, first record for our region of this species which lives in deadwood as a larva.

Agapanthia villosoviridescens (DeG.) The Gully, Avon Gorge, Bristol (vice county 34) ST564 746 28 May 2012 Ray Barnett. A distinctive species which has increased in the east and Midlands of England and is slowly establishing itself in our region.

Stenurella melanura (Linnaeus) St Anne's Park, Bristol (vice county 6) ST 619 721 August 2012 Michelle Fowler. A pair of this localised long-horn species.

Black-headed Cardinal Beetle *Pyrochroa coccinea* (L.) Middle Wood, Englishcombe, Bath & NE Somerset (vice county 6) ST726 617 21 May 2012 Tim Corner. Much rarer than the usual *P. serraticornis* with its red head, this species is usually an indicator of good dead wood habitat.

Tillus elongatus (L.) The Gully, Avon Gorge, Bristol (vice county 34) ST564 746 13 June 2012 Ray Barnett. An indicator species of good deadwood habitat.

Ischnomera cyanea (Fabr.) Arnos Vale Cemetery, Bristol (vice county 6) ST60 71 30 June 2012 Ray Barnett. Another species whose larvae feed in deadwood.

Cryptocephalus moraei (L.) Arnos Vale Cemetery, Bristol (vice county 6) ST60 71 30 June 2012 Ray Barnett. A local species associated with St John's Wort.

Rosemary Beetle *Chrysolina americana* (L.) St Anne's Park, Bristol (vice county 6) ST 619 721 June-September 2012 Michelle Fowler. The first records from our region of this, originally Mediterranean, species date from 2006 and 2007. I had been expecting it to have become well established on both Lavender and Rosemary by now but either gardeners are not reporting it to naturalists or it is genuinely struggling to adapt to our particular micro-climate.

Hymenoptera (bees, wasps and ants)
Zaraea lonicerae (L.) Bishopston, Bristol (vice county 34) ST585 757 11 April 2012 Ray Barnett. A rarely seen but distinctive sawfly.

Tree Bumblebee *Bombus hypnorum* (L.) Bishopston, Bristol (vice county 34) ST585 757 1 March – 1 June 2012 Ray Barnett. A nest in a roof space was very active until June, one of several such nests reported anecdotally by members of the public attending the annual Bristol Festival of Nature in June 2012 along with several sightings by experienced recorders eg by Jon Mortin as follows: Ashley Down College, Bristol (vice county 34) ST 595 753 1 March 2012 and 15 March 2012 Jon Mortin, both queens.

St Andrews Park Pond, Bristol (vice county 34) ST 593 751 11 March 2012 Jon Mortin, one seen. Narroways LNR (Ash Wood), Bristol (vice county 34) ST600 750 10 June 2012 Jon Mortin, one seen. Upper Belmont Road, Bristol (vice county 34) ST592 754 18 June 2012 Jon Mortin, one worker seen.

Diptera (true flies)
Mydaea corni (Scop.) Narroways LNR, Bristol (vice county 34) ST600 750 11 November 2012 and also Boiling Wells Lane, Bristol (vice county 34) ST602 755 18 November 2012 both Jon Mortin det. Stephane Lebrun. The first and second records of this species from the BRERC area.

Rhingia rostrata (L.) The Tow Path below Leigh Woods, Avon Gorge, North Somerset (vice county 6) ST56 73 September 2012 Tony Cottrell. Blagdon Lake, Bath & N E Somerset (vice county 6) ST5 5 16 August 2012 Nigel Milbourne. Chew Valley Lake, Bath & N E Somerset (vice county 6) ST5 5 22 August 2012 Ian Stapp and, same location, 23 August 2012 Richard Mielcarek. Previously a very rare fly in the region but one which seems to be increasing nationally as well as locally.

Volucella inanis (L.) Boiling Wells Lane, Bristol (vice county 34) ST602 755 26 August 2012 and St Andrews Park Pond, Bristol (vice county 34) ST 593 751 28 August 2012 both Jon Mortin. This recent impressive addition to the local list continues to be present in good numbers.

Sargus iridatus (Scop.) Breach Wood, Bath & NE Somerset (vice county 6) ST726 628 29 May 2012 Jon Mortin. Only the 7th record on the BRERC database of this soldier fly.

Dotted Beefly *Bombylius discolor* Mikan Blagdon Lake, Bath & N E Somerset (vice county 6) ST5 5 27 March 2012 Nigel Milbourne. A species which may be increasing in the region at present.

Phasia hemiptera (Fabricius) The Tow Path below Leigh Woods, Avon Gorge, North Somerset (vice county 6) ST56 73 September 2012 Tony Cottrell. Just one report of this parasitic fly which seemed to be common in 2008.

Arachnida

Cave Spider *Meta bourneti* Simon Abbots Pool, Abbot's Leigh, North Somerset (vice county 6) ST52 73 Andy Pym & Mark Pajak, det Mark Pajak. The rarer of the two cave spider species.

Purse Web Spider *Atypus affinis* (Eich.) The Gully, Avon Gorge, Bristol (vice county 34) ST564 746 07 October 2012 Mark Pajak, Andy Pym & Ray Barnett. Cast skin found in purse web.

Amphipoda

Landhopper *Arcitalitrus dorrieni* (Hunt) Bishopston, Bristol (vice county 34) ST585 757 26 February 2012 Ray Barnett. Common under flower pots; an established alien.

Annelida

Blue-grey Worm *Octolasion cyaneum* (Savigny) Ashley Hill, Bristol (vice county 34) ST597 749 4 March 2012 and Sefton Park Road, Bristol (vice county 34) ST596 753 26 April 2012 both recorded by Jon Mortin. The first records of this worm on the BRERC database although presumably overlooked.

In the Footsteps of Henri Audcent -Leigh Woods

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There are some entomologists from past decades who left a useful record of the species that they, and their fellow entomologists, found. It allows us to compare their records with what we can find today. One such naturalist was Henri Audcent. (1875-1951) who collected and recorded the Diptera (two-winged flies) in the Bristol area some 80 years ago. He left no field notebooks, but it is possible, from his series of papers 'Bristol Insect Fauna Diptera' in the Proceedings of the Bristol Naturalists Society, to read the records compiled by him between 1928 and 1949. In this last paper, for which he used the Kloet & Hincks Check list of 1945, Audcent summarises the records and helpfully lists all of the preceding papers about the Diptera of the Bristol area. He did not describe the locations in any detail but I have briefly re-visited and recorded the craneflies (Diptera, Tipuloidea) from two of the sites for which his records exist, so that some comparisons can be made.

The first of these sites is Leigh Woods NNR, an area of wet woodland situated on Carboniferous limestone on the west bank of the River Avon. [VC 6] It falls into three grid squares (ST5474, ST5574, ST5573), lies at a maximum of about 100m and slopes quite steeply down to the River Avon to the east.

Where the species was very common, Audcent records them as 'G and S (Gloucester and Somerset), common'. It is probable that many species recorded thus were also found at Leigh Woods. Where this seems likely I have indicated these on the Table of Results as 'common' (See Appendix I)

H.J. Charbonnier published the first list of Diptera of the Bristol District in the Proceedings of the Bristol Naturalists' Society in 1912. However, no names of locations were given, and there were none listed from Leigh Woods. He did list the collectors who donated records, like V.R. Perkins of Wooton-under-edge, and C.J. Watkins of Painswick, and it would be interesting to read their notebooks.

Tipulidae (Daddy Long-legs) - 21 species
There are no Audcent records for the genera *Ctenophora, Dictenidia, Tanyptera, Dolichopeza* and *Prionocera* from Leigh Woods. d'Assis-Fonseca recorded *Ctenophora pectinicornis* in 1943, and I have added *Dolichopeza albipes*
He recorded 13 species in the family Tipulidae and four of these species were the black and yellow 'Tiger Craneflies (genus *Nephrotoma*) are listed: *N. analis, cornicina, flavipalpis* and *guestfallica. N. analis* and *N. guestfallica* are both species of sandy river banks which emerge in June -July, so may be found by the stream that flows from the ponds at Paradise Bottom (ST5474). The bed of this stream seems sandy, but perhaps it is silt, stained brown with iron compounds? *N. flavipalpis* is a wet woodland species which usually emerges in July, so searching then will probably find this species. *N. cornicina* prefers drier habitats and so it may be found on thinner soils on the limestone. He recorded *N. appendiculata* as 'common' so he may have found it here. I have added *N. quadrifaria* to Audcent's list from Leigh Woods, recorded in Nightingale Valley (ST 55 73) He lists it as 'common and widespread' and it is still a common woodland species.

13 species of *Tipula* are recorded from Leigh Woods and in addition I have included *Tipula lateralis*, *T. oleracea*, and *T. paludosa*, which are recorded as 'G. and S. common'. It may well be that, on my early June visit, I was too late to record some of the Spring craneflies, such as *T. varipennis* and *T. flavolineata*, both of which I recorded at other sites in May.

Others such as *T. signata* and *T.pagana*, emerge in the Autumn and may be collected in late September or October. *Tipula lateralis* was recorded by me from the bank of the River Avon. It is probable that the rare *Tipula (Vestiplex) nubeculosa* was wrongly identified. Its habitat is in mountainous regions. It is perhaps significant that Audcent does not mention this record in his paper of 1940. However, its close relative *Tipula (Vestplex) scripta* does occur in Leigh Woods, and was recorded by Audcent. It is difficult to be certain what Audcent meant by the name *Tipula hortulana.*

It is a synonym for *Tipula pseudovariipennis* Czizek but this is less common. In his 1932 paper he also lists it as a synonym for the commoner *T. submarmorata* Schummel (Audcent 1932) and this is probably what he meant.

I also added the 'White-footed Ghost' (*Dolichopeza albipes*) and *Tipula maxima* to Audcent's list of Tipulidae. Both of these were swept on different dates from the *Cupressus* at the bottom of the 'Waterfall' (ST5474). The larvae of the former species feeds in liverworts and the habitat of the adult is in the deep shade, often beneath an overhanging stream bank, or beneath vegetation. *T. maxima* is one of our largest flies and has a very distinct pattern of chocolate markings on its wings. It's larvae feed in the sediment in streams.

Cylindrotomidae - 1 species
Diogma glabrata was recorded in Leigh Woods by A.E. Hudd, though no date is given. This is a rare species and Gibbs (2002) writes that a specimen caught in Monks Wood, north of Bath in July 1999, was the first record for the area since 1929, so it seems that it has not been recorded in Leigh Woods since Audcent's time.

[I must confess that when I saw the yellow thorax and black thoracic stripes of *Lipsothrix nervosa,* together with the three medial veins I thought at first that I had *Diogma glabrata* in the net. *L. nervosa* was not added to the British list until 1938, and if A.E. Hudd took it before then, he would certainly wonder what it was, and may perhaps, like me, have identified it as *Diogma.*]

Pediciidae - 5 species
At that time these craneflies were grouped in the family Limoniidae, sub-family Limnobiinae. Rather surprisingly none of this group of 'hairy-eyed craneflies' was recorded by Audcent from Leigh Woods. The larvae of some species live in streams and are predatory on smaller invertebrates. Presumably all of the streams now present in Leigh Woods were flowing in Audcent's day.

The waterfall is an excellent habitat and the large, orange *Pedicia littoralis* was common there at the beginning of June. The smaller dark *Dicranota* species present more of a problem and genitalia preparations are advisable. Two species were found by the stream flowing northwards from the Paradise Ponds.
The larvae of species of *Ula* feed in fungi, and they were all grouped together as *Ula pilosa* in Audcent's day, and later as *U. sylvatica.* It was only in 1962 that two British species were separated. This is recorded by him as 'bred' in 1923, and it emerged from a fungus, *Tricholoma album* (Schaef) in February. (Audcent 1949) I collected a specimen in early June which was identified as *Ula sylvatica. Tricyphona immaculata* is a common wetland species.

Limoniidae - 53 species
For the full list see Appendix I.

Chioneinae:
Many of these species are small and require a good microscope to identify them accurately. We are more aware today that differences in the structures of genitalia may be minute, or concealed by bristles and so identification in the field may be impossible so perhaps the major difference in the earlier and later lists lies in the number of these small species on the latter. The genus *Rhypholophus* emerges in the Autumn. *Gonomyia recta*, and *G. simplex* are two local species associated with limestone, as is the rarely recorded *Molophilus lachschewitzianus*. This was added to the British list in 1973 by Alan Stubbs. *M. corniger* and *M. variispinus*, both Notable, were also found here. The latter was not added to the British list by Alan Stubbs until 1977.

Limnophilinae
There is not much to be said about these common species. The two species of *Euphylidorea* emerge in May and I may have been too late to find them.

Limoniinae
Although records from wet woodland occur, *Dicranomyia didyma* is a species which occurs near waterfalls and their larvae feed in the surrounding damp mosses. *Dicranomyia sericata*, recorded by A.E. Hudd, is associated with limestone quarries, so these would be worth investigating. David Gibbs reports (pers. com.) that he has taken this species in the limestone quarry on the opposite bank of the River Avon, so Hudd's record is very plausible, although the quarries may now be too scrubbed over to support this species. I have not yet found either of these species in Leigh Woods
Species of the genus *Lipsothrix* are associated with wet rotting wood in which their larvae feed and which is in plentiful supply around the streams here. *Lipsothrix remota* is a common species, but *L. nervosa* is more local and associated with calcareous habitats. It was discovered as new to science in 1938 by F.W. Edwards (Edwards 1938)

Summary
There are now a total of 85 species on the check list for Leigh Woods. One of these I have omitted as dubious, but 37 have been confirmed by the recent visits. The most notable are those restricted to wet limestone woodlands, of which this is an excellent example.

The other Audcent site that we visited was Shapwick Heath and I will write a piece about that for the next volume. If anyone has records of craneflies from there, or from Leigh Woods I would like to hear from them so that we can build as complete a picture as possible.

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Acknowledgements
Thanks to Mark Pajak for organising the site visits, and to members of the Bristol Naturalists' Society for their company.

APPENDIX 1 - RESULTS

Species	H Audcent	J.Kramer
Tipulidae		
Ctenophora pectinicornis	1943	
Dolichopeza albipes		2013
Nephrotoma analis	1924	
Nephrotoma appendiculata	Common	
Nephrotoma cornicina	1918	
Nephrotoma flavipalpis	1920	
Nephrotoma guestfallica	1920	
Nephrotoma quadrifaria	Common	2013
Tipula maxima		2013
Tipula vittata	1944	
Tipula flavolineata	1925	
Tipula lunata	common	
Tipula luteipennis	1925	
T. submarmorata Schummel	1925	
Tipula varipennis	1926	
Tipula obsoleta	1924	
Tipula pagana	1928	
Tipula rufina	1932	
Tipula signata Staeg	AE Hudd	
Tipula variicornis		2013
Tipula oleracea	common	
Tipula paludosa	common	
Tipula scripta	1926	
[Tipula nubeculosa	AE Hudd	
Tipula lateralis		2013
Cylindrotomidae		
Cylindrotoma distinctissima	1929	
Diogma glabrata	AE Hudd	
Dicranota bimaculata		2013

Dicranota pavida		2013
Pedicia littoralis		2013
Tricyphona immaculata	1928	2013
Ula sylvatica	1923	2013
Cheilotrichia cinerascens	AE Hudd	2013
Erioptera flavata	1918	
Erioptera lutea	AE Hudd	
Erioptera lutea	AE Hudd	2013
Ellipteroides lateralis		2013
Gonomyia recta		2013
Gonomyia simplex		2013
Ilysia maculata	1918	2013
Ilisia occoecata		2013
Molophilus appendiculatus	1925	2013
Molophilus cinereifrons	AE Hudd	2013
Molophilus corniger		2013
Molophilus griseus	AE Hudd	
Molophilus lackschewitzianus		2013
Molophilus medius		2013
Molophilus ochraceous	1925	2013
Molophilus serpentiger		2013
Molophilus variispinus		2013
Ormosia albitibia	1930	
Ormosia nodulosa	1925	2013
Rhypholophus bifurcatus	1928	
Rhypholophus haemorrhoidalis	1925	
Tasiocera murina	1927	2013
Limnophilinae		
Austrolimnophila ochracea	Common	2013
Eloeophila submarmorata		2013
Euphylidorea dispar	1920	
Euphylidorea lineola	1925	
Epiphragma ocellare	1927	2013

	H Audcent	J.Kramer
Dicranophragma adjunctum	1925	
Dicranophragma nemorale		2013
Limnophila schranki		
Neolimnomyia filata		2013
Paradelphomyia senilis		2013
Pseudolimnophila sepium		2013
Achyrolimonia decemmaculata	1937	2013
Dicranomyiamitis var affinis		
Dicranomyia chorea	'common'	2013
Dicranomyiamitis var lutea		
Dicranomyia modesta		2013
Dicranomyia sericata	AE Hudd	
Dicranomyia fusca		2013
Limonia flavipes	'common'	2013
Limonia macrostigma		2013
Limonia nubeculosa	'common'	2013
Limonia phragmitidis	1926	2013
Limonia stigma	AE Hudd	
Limonia trivittata		2013
Lipsothrix nervosa		2013
Lipsothrix remota		2013
Metalimnobia bifasciata	1925	
Metalimnobia quadrinotata	1918	
Neolimonia dumetorum	1918	2013
Rhipidia maculata		2013

Chironomidae in Sneyd Park

Robert Muston

Whilst pond dipping in Sneyd Park pond last Autumn (2012) I found something which I had not come across before. I subsequently found a few more and I took one home to photograph. Closer examination suggested that they were an egg mass of some kind, and so they were set aside to see whether they would hatch. See photo4. Placed in a jar of pond water with a loosely fitting lid, and left outside to avoid any additional undue warmth, small organisms, two mm in length hatched out. Specimens were quickly isolated with only a few in each glass container and were periodically fed on Volvox, a colonial algae abundant in the pond at that time. See photo 6

Closer examination revealed that these organisms were midge larvae belonging to the family Chironomidae. Once hatched, each larva builds small tube from mud and detritus in which they continue to live, emerging to feed and quickly retreating back into their mud tube when only their head may be seen.

The larva's head is provided with a pair of strong mandibles which are used to catch the food before conveying it to the mouthparts where the food is shredded and then eaten. Also on the head are rudimentary eyes. Just below the head is a clawed appendage (parapod), with a pair of similarly clawed parapods at the rear end. These parapods are used to provide a strong grip whilst the organism is inside its mud tube. Also at the rear end are pairs of gills which have a good blood system thus enabling an adequate supply of oxygen from the water without the need to come to the surface and anal tubules through which it excretes. See Photo.5

The Chironomidae

This description is of but one example of this family of midges which comprises 139 genera within which there are about 450 individual species. Chironomids are found in almost every form of aquatic habitat and whilst most are found in freshwater, a few are

found in brackish water, and two species have been found in the marine environment. Different species will tolerate extremes of temperature, water current speed, and dissolved oxygen levels, in addition to toleration of pollution. They are often associated with degraded waters with low biodiversity having become adopted to anoxic (low oxygen content) conditions. The Chironomids are important as indicator organisms, i.e., their presence, absence or relative abundance may indicate whether pollutants are present. They are also important food items for fish and other aquatic organisms including newts, water scorpion, water boatmen and diving beetles.

Midge larvae have turned out to be fascinating organisms to observe and so it is hoped that this short article will be an introduction to a more extended piece in the course of preparation.

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Phenology Report 2011-2012

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The data upon which this article is based is derived from a standard weekly walk through ST5673, from North to South, following the edge of the Gorge as closely as is practical. The walk runs from the Peregrine Watchpoint to the Clifton Rocks Railway below the Suspension Bridge and is 1000m long. Every week all the plant and tree species in flower, and the number of species with ripe fruit, are recorded. This walk has been done since 2000. In all 263 species have been identified though the maximum number recorded in any one year is 229. The survey began in 2002, though there are earlier records for some species back to 1997. Other significant events are recorded for tree species, including bud break, and the date when the leaves first turn colour, the date of first leaf fall, of full colour turn and the date of becoming bare. The definition of first flower is that the anthers be visible. For other events the criteria are more subjective. The dates are all recorded as days of the year, starting on January 1st. The relevant data are submitted annually to the Woodland Trust's Natures Calendar. The principle that is followed is that a standard transect regularly repeated by the same observer will give truly comparative results.

The problem for all our wildlife is that, though we have a temperate climate, they have to deal with the extremes, and the years 2011 and 2012 were remarkable for this. 2011 was the second hottest year since 1853. It had the third cold winter in a row, with an exceptionally cold December 2010, (the coldest locally since 1916) that saw three weeks of lying snow. A wet January was followed by a warm February and April was the warmest since 1853. The average temperature for spring, (March, April, May) was in consequence, the second highest since 1853. This was followed by an average but wet summer, the fourth in succession, and the warmest November and autumn temperatures since 1853.

2012 was the wettest year since 1853. After an exceptional run of three cold winters, winter had an average temperature, March was the warmest since 1853, summer was the wettest ever, and autumn had 50% more rain than average.

	Winter	Spring	Summer	Autumn	Year
Avg T °C	7.5	13	20.2	14	13.7
2011	6.8	16.1	20	16.8	15.5
2012	9.1	15.3	20.3	14.3	14.7
Avg Rain mm	79	60	74	87	904
2011	72	21	90	68	847
2012	74	88	149	139	1420

Table 1 A summary of the seasonal temperatures and rainfall compared with the long term average

Spring first flowering.

Interestingly the response of spring plants was that both years had normal springs. Chart 1 shows the average date of 18 common species on the Downs that come into flower in the first four months of the year since 2000. The two very late springs were 2006 and 2010. 2008 was the earliest. What is remarkable is the huge range that these species show. The difference between the average earliest date and the average latest date for all 18 species is 42 days, six weeks, and individual species have a range of between 18 and 82 days.

Full details of the dates 2002-2012 are in Appendix 1

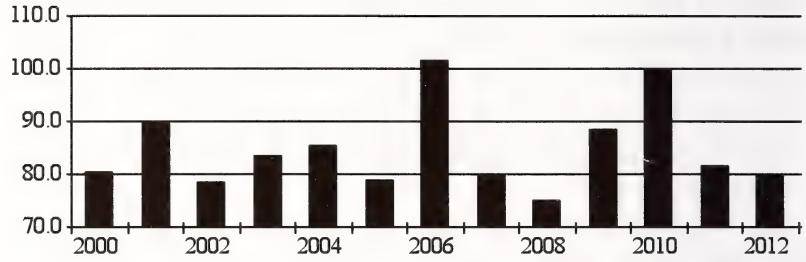


Chart 1. The average date of first flowering of 18 spring species, 2000-2012

The impact of the hot April in 2011 came in the plants that normally flowered after the start of May. Chart 3 is based on the dates of 80 species and shows the average number of days that species came into flower earlier than the decadal average in each ten day period of May and June. In many cases this was the earliest date recorded since 2000. It was remarkable that the impact of a hot spell in April was actually greatest at the start of June, and could still be seen at the end of that month.

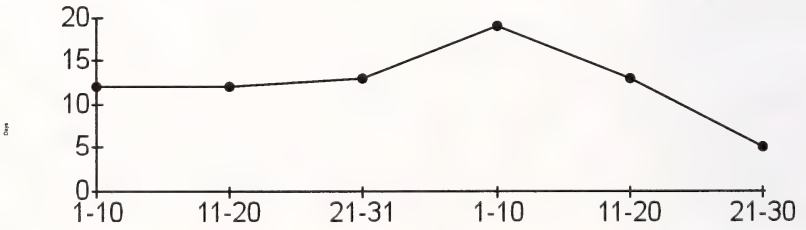
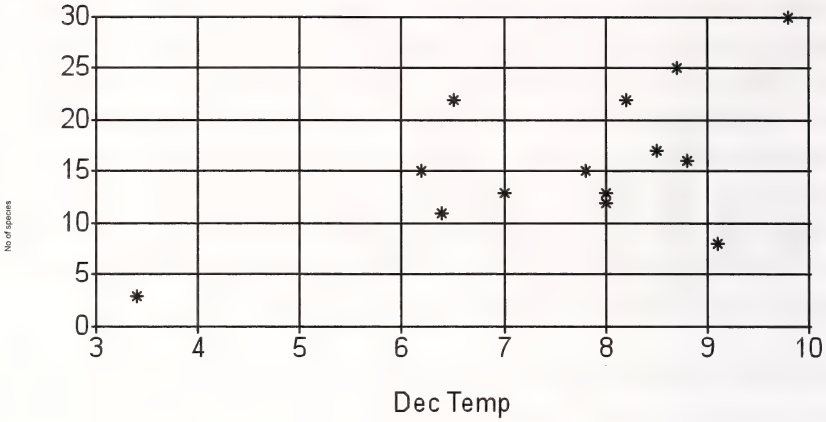


Chart 2. The average number of days earlier than usual that species came into flower in each ten day period of May and June.

New Year's Day count.
The New Year's Day count of all the species in flower recorded on January 1 since 2000 now has found a total of 53 species. On New Year's Day 2011 there were only three species, as a result of the bitter December in 2010. December 2011 had an average of 9.8C maximum temperature, the warmest since this survey began, and the count was 30 species, the highest since 2006. There were four new species, Basil Thyme, Cow Parsley, Great Lettuce and Red Clover. New Year's Day 2013 had just 16 species, but Dog Mercury, Field Speedwell and Meadow Buttercup were all new species.

Of the 53 species fifteen have only been recorded once in the 14 years, and only Daisy and Gorse have been recorded every year. Each species has been recorded on average four times, and each year there have been an average of 15 species in flower. Most of the plants recorded are autumn survivors, but in 2013 both Hazel and Dogs Mercury and Perennial Wallflower were new spring plants in flower.

Clearly a combination of the rainfall and temperature in the two months prior to January 1st will influence which species are able to be in flower, and, because it only requires a single specimen of the species to be recorded, there is a strong chance element involved. The very low light levels of mid-winter, and the very small number of pollinators, have the consequence that very few flowers are pollinated, and seed production is in consequence very low, and that species stay in flower for a long time. But for annual plants getting an early start in the autumn is a good way to maximise production when the light increases. In 1900 the thirty-year average of maximum winter temperature was 7.0°C, and this increased to 8.3°C by 1939. Since then it has fallen back to 7.3°C by 1985, then rising to 8.2°C by 2008. Should there be any further increase plants adapted to survival should do well.



C

hart 3 The correlation between average December maximum temperature and the number of species in flower on January 1st

Tree growth. The active life of a tree depends partly upon how early in spring it can leaf, and how late in the autumn it can continue, and partly upon rainfall. In particular summer rainfall leads to a second shoot production called Lammas growth, which happens in August and September. Normally for most native trees the growth of shoots happens in a rapid burst in early spring, and then the trees energy is devoted to flowering, ripening the seed, and building the buds for the following year. But if it is warm and wet enough the Lammas shoots can be as long or longer than the spring ones, and Oaks and Maples in particular produced spectacular lammas growth in 2012. However in terms of the overall growing season, which for twelve native species in Bristol averages about 220 days, both 2011 and 2012 had average years. There was a months difference between 2005, the longest growing season and 2009, the shortest, and it is a combination of this and the rainfall that will create the difference between annual growth rings. Each tree species also has its own pattern. Whitebeam has the shortest average growing season at 186 days, Elm the longest at 244 days. The variation between the longest

and shortest growing season is also different for each species. Oak has the least variation, 39 days, Whitebeam the most at 83 days.

Wild Harvest. The weather will also influence the productivity of each species. In 2012 neither Beech nor Whitebeam flowered, whereas Ash had a bumper crop that year, as did Sycamore and Holm Oak. But in general tree productivity was poor in 2012, which will have had an impact on the over-winter survival of many species of mammals and birds. Since 2002 I have recorded each week the number of species that still have nuts or berries available on the tree for consumption. A small crop will be rapidly consumed, whereas a large one will last longer. Some species such as Elder are always consumed rapidly, and others, such as acorns, are long-lasting on the ground after they have fallen from the tree, so the figure gives a very rough estimate of size of the harvest. The annual pattern is clear, with a peak in mid-October, (week 41), and a long gap from mid-April (week 16) to the end of June (week 26).

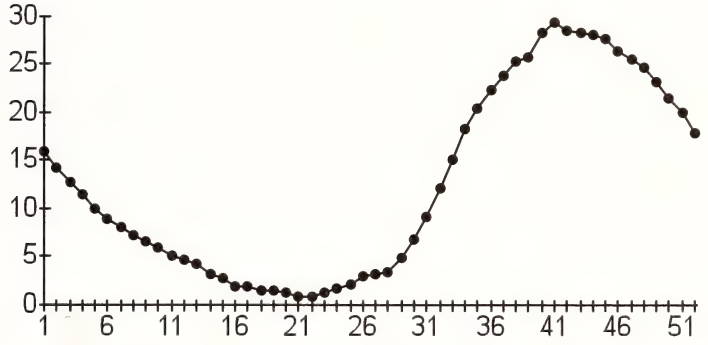


Chart 4. Weekly average number of species with fruit/nuts available, 2002-2012

It is possible to compare the annual pattern with the average, and Chart 5 shows the number of species with ripe fruit between the start of July and the end of the year for 2011 and 2012. 2011 had an early harvest, caused in part by the early flowering dates that the April temperature encouraged, and a subsequent wet summer with average temnperatures. 2012 the harvest started late, and the number of species every week was close to or at the minimum recorded since 2003. Chart 6 shows a comparison of the average number July to December each year.

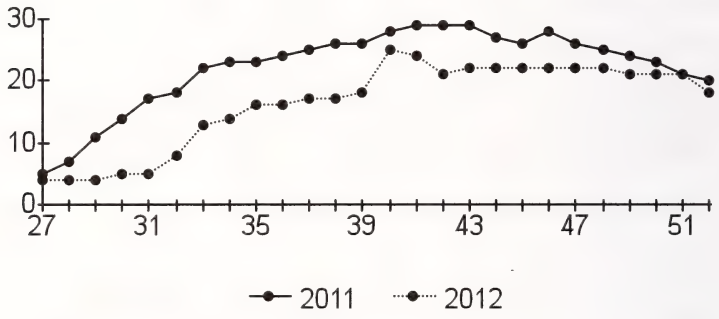


Chart 5 Comparison between the size of the harvest in 2011 and 2012, July to December

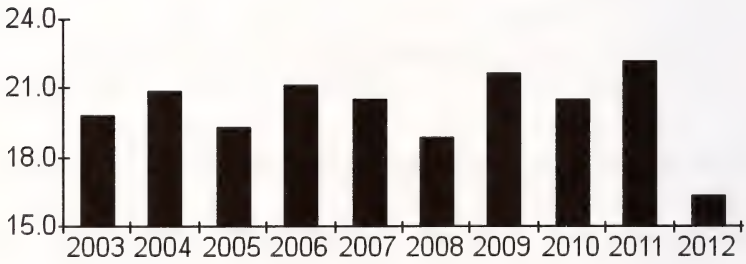


Chart 6 Average number of species with fruit July-December, 2003-2012

Appendix 1
The dates of first flowering of 18 spring species, 2002-2012

	2	3	4	5	6	7	8	9	10	11	12	Av
Hazel	20	19	10	7	21	-2	27	23	31	16	22	18
Celandine	39	46	32	-5	45	28	27	53	77	51	1	36
Purple Plum	42	29	36	29	79	28	31	57	79	65	50	48
Daffodil	43	46	40	22	72	35	40	57	79	51	57	49
Alexanders	48	69	82	1	72	62	-9	60	77	37	57	51
Wallflower	34	69	82	79	107	70	67	81	80	79	57	73
Blackthorn	69	75	67	72	99	62	67	81	100	79	71	77
Ash	76	74	82	86	92	98	75	87	94	79	84	84
Cherry	83	89	82	86	107	90	83	87	87	86	84	88
Laurel	82	96	88	83	113	90	89	94	109	93	92	94
Cow Parsley	97	110	102	100	113	105	27	102	113	99	89	96
Horse Chestnut	97	103	112	110	119	105	105	105	115	79	63	101
Sycamore	97	96	102	113	113	98	111	95	104	99	106	103
Lilac	88	97	110	110	127	104	111	109	109	98	106	106
Hawthorn	97	110	115	120	127	105	118	115	128	107	121	115
Ox-eye Daisy	124	116	129	120	127	118	103	115	128	114	106	118
Elder	138	116	122	135	142	112	132	130	143	114	140	129
Dog Rose	139	145	143	148	154	125	145	144	150	121	134	141

Appendix 2 Species present on New Year's Day count on the Downs, 2000-2012

	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Adria Bellflower	y	y	y	y	y	y	y	y	y	y	y		y	
Alexanders					y			y					y	
Alkanet						y	y	y	y	y			y	
Barren Strawberry					y									
Basil Thyme													y	
Blackberry			y		y		y		y				y	
Bristly Oxtongue							y						y	
Canadian Fleabane									y					
Celandine					y								y	
Chickweed							y							y
Clary							y						y	
Cow Parsley													y	
Daisy	y	y	y	y	y	y	y	y	y	y	y	y	y	y
Dandelion		y		y	y		y	y			y		y	y
Dog mercury														y
Feverfew								y	y	y				
Field speedwell														y
Golden Rod								y						
Gorse	y	y	y	y	y	y	y	y	y	y	y	y	y	y
Great Lettuce													y	
Groundsel	y	y	y	y		y	y	y	y	y			y	y
Hairy bittercress									y		y			y
Hawkweed								y						
Hazel							y							y
Hedge Mustard							y						y	
Herb Robert	y						y						y	
Hogweed			y										y	
Holly						y			y	y	y			

Ivy	y		y	y			y	y	y	y		y	y	
Ivy-leaved Toadflax	y	y	y	y	y	y	y	y	y				y	y
Meadow Buttercup														y
Mexican fleabane								y	y	y	y			
Nettle							y							
Nipplewort								y					y	
Ox eye daisy									y	y				
Oxford Ragwort		y				y		y						
Petty Spurge						y	y	y	y	y	y		y	y
Ragwort					y		y						y	
Red Clover													y	
Red Nettle		y				y	y		y	y			y	y
Red Valerian		y	y	y	y	y		y	y	y			y	
Rock Rose											y			
Shepherds Purse				y	y	y	y						y	y
Small Scabius						y	y	y	y	y	y		y	
Smooth Sowthistle		y	y	y	y	y	y	y					y	
Snapdragon					y									
Thyme									y					
Trailing Bellflower		y	y	y	y	y	y	y	y		y		y	
Viburnum tinus													y	y
Wallflower		y												y
Wood Avens							y	y	y					
Yarrow				y	y									
Yellow Fumitory	y	y	y	y	y		y	y	y	y				

Book Reviews

Dragonflies and Damselflies of the Bristol Region, by R.J. Barnett, R.M. Andrews, T. Corner, R.J. Higgins, J.P. Martin and A. Pedlow; Published by BRERC.

A review by Robin Williams, www.insectsandflight.com.

On first glancing through this book I thought what a fine impression it gave. A more detailed examination went on to confirm this. It is so comprehensive that it is easy to forget this is a purely local study and not a national one. The layout, first-class photographs and standards of printing make it an extremely attractive book, as well as being both practical and useful. The editors, authors and photographers have much to be proud about.

The book is based around the records kept over the years by the Bristol Regional Environmental Centre (BRERC) and is a development from the previous book by Simon Randolph in 1992, *Dragonflies of the Bristol Region*, although the actual area covered is now rather less. Indeed my only sadness is that it no longer covers much of Mendip, which is so rich in dragonfly life. The biggest changes are recording vagrants and visitors instead of concentrating solely on breeding populations. The area has seen some amazing and unexpected visitors in recent years.

Interestingly, the book starts with the geological situation of the area and describes ancestral developments, which does help set it all in context. A chapter on Conservation and habitats is packed with information on ponds, streams, levels and other wetlands enabling us to understand the area in much more detail, as well as how local plants affect populations. It goes on to discuss climate change, which is already showing benefits to the *Odonata* population. It ends with several case studies of particular locations and reserves which are invaluable to visitors and local watchers.

The history of dragonfly recording in the area is well covered. It takes in earlier efforts, going on to activities of bodies like the British

Dragonfly Society, as well as the growing interest from bird watchers. The result of all this is that nearly 24,000 records have been analysed, by 600 odd recorders, covering from 1921 to 2011, which are now held in BRERC, as well as being used as the basis for this book.

The large main section concerns species accounts for each of the many *Odonata* recorded in the region. This an extremely comprehensive and well thought-out package, laid out similarly for each species and covering virtually everything that you might need to know. (Inevitably, I yearn for a section on identification but realise there are plenty of good books covering that, including my favourite, *A complete guide to British Dragonflies*, by Andrew McGeeney, long out of print). The text describes suitable habitats for the species and where it is likely to be found in the region. Each has a very clear map showing the main locations, together with a graph showing when the insects are in flight. Above all, though, there are photographs illustrating different stages and the sexes – and all are of the highest standard. It is difficult to imagine what else is needed to plan outings in search of particular dragonflies.
This remarkable and beautiful book is a credit to all who have been involved in its production.

Avon Atlas 2007-11 by R. L. Bland and M. Dadds
Published privately, copies are available from the first author
A review by Harvey Rose.

Straight away I should say that this publication is an important addition to the bird literature of the Avon area which would not have been possible without the long hours spent in the field by an 'army' of volunteer observers and the hundreds of hours spent by the authors and some others (including John Tully who unfortunately did not live to see the final product) organising the project, collating the material and writing the final report which runs to 197 pages.

During the period November 2007 to July 2011 the British Trust for Ornithology (BTO) organised a national survey of the birds occurring in the UK. Effectively this was two combined surveys, one for summer (breeding) and one for winter, and so it covered the major aspects of the birdlife of the country except for one, migration. An Avon survey following similar lines was organised in conjunction the national survey, and the Atlas under review provides an account of this local survey. It begins with an introduction giving details of the methods used, a description of the area covered, and a thorough summary of the results including several tables listing the changes over the past 30 years.

The main body of the text is the systematic list, 143 pages, which provides data on 154 species. In the past there have been three atlas projects also organised by the BTO, from 1968 to 1972 (for breeding and using 10km squares), from 1981 to 1984 (for winter and again using 10km squares, but locally including a tetrad survey), and from 1988 to 1991 (for breeding but now using tetrads). The new Avon Atlas uses tetrads as the basic unit of study and compares results for the 2007 to 2011 survey with those for the second and third of the BTO surveys listed above.

So for summer and/or winter detailed information is provided on how the species under discussion has fared over the past thirty years. In summer the Barn Owl came out best having increased from a very low ebb by 2667% and the Tree Sparrow came out worst with a drop of 60%, and in winter it was the Canada Goose that came out best (800%) but again it was the Tree Sparrow that came out worst (-83%). For a good proportion of the species covered information taken from the Breeding Birds Survey (BBS) and other projects is also included and provides data on a yearly basis for at least part of the period. But perhaps most importantly, for almost all species a map is also given showing the distribution in each of the 400 plus tetrads of the BTO Avon area. (This area follows the Ordnance Survey 10km grid squares and so includes a part of Somerset, mainly the Mendips, but excludes a small part of North Avon.)

For each species covered a detailed description is given of their current status and how this has changed during the past quarter century, and the fact that all this information is available in one place is most welcome. The book ends with twelve appendices summarising the data and providing some further information.

As I see it, there was one problem with the design of both the BTO and local surveys, the exclusion of migration. Observers were asked to record what they saw, so consequently migrants were recorded. And with some species there is both a resident population and a migrant one. For breeding species this did not matter because we have a clear idea what species are involved, but for non-breeders it is a different matter. The result was that the list of species included in the main systematic list is a bit uneven. For example Whimbrel is included, most pass through to their breeding grounds in Iceland and elsewhere but a handful of non-breeders, probably immature birds, do spend at least part of the summer here. On the other hand Grey Plover is not included even though a sizable number (up to 100) do winter regularly on the coast.

There is a table in the Appendix listing 90 'less common species' and some escapes, but some, like Grey Plover, do not really deserve this description. Several other winter species could have been included, for example Knot, Short-eared Owl and Water Pipit. A number of species occur fairly regularly during the summer, for example some pelagic seabirds, several raptors and Common Tern, but their absence from the main list is not really a problem because they do not breed. This is only a minor criticism but the project would have gained with a clearer definition of what to include and what to leave out. Also the text would have benefitted from the services of a good copy editor. These minor niggles do not detract from what is very welcome addition to the literature on the avifauna of the area.

Bristol Safari by Ian Wade,
pubished 2011 by Redcliffe Press

Review by R L Bland

Bristol is a very remarkable city both for the variety of its wildlife, and the extent that it has been studied both by this Society and Bristol University over the years. A great deal is known about the population and changes in a wide variety of trees, plants, birds and mammals over the past 150 years, but this book adds a dimension to this knowledge because of its remarkable photographs, and the complex and subtle relationships that exist between the wildlife and both the human and the built environment of the city that they demonstrate.

The book emphasises the importance of species that are widespread and abundant, especially the Foxes that have been studied in great detail both by the University Biology Department and by the author, who knows many of them as individuals. There are extraordinary close-ups which reveal the patient skills of a born naturalist dealing with an animal that is very much at home in the city, but remains appropriately wary.

The Herring and Lesser Black-back Gulls, which did not breed in the city before 1970, have been copiously ringed and studied for thirty years, are revealed in astonishing detail. And throughout the book invites the reader to open his eyes to the life of the gutter, the wall, the pavement, as well as the 99 Sites of Nature Conservation Interest.

The rapidity of change in urban wildlife is often not appreciated, but reflects the manner in which there are constant changes in the way that we conduct ourselves. Subtle changes, such as the shift from black bin bags to wheelie bins for our waste, or the use of bark chippings as mulch in our gardens, or the creation of acres of flat roofs, or a small switch in the mowing regime in our parks, all have a huge impact on the pattern of wildlife species and populations. Urban areas change much faster than rural ones, and have much a much more varied range of habitats, and hence far higher biodiversity. Every garden is different from every other, and, however manicured or neglected they may be, gardens provide habitats for thousands of species.

This book does much to illustrate why we have been chosen to be the Green Capital of Europe in 2015, and to encourage everyone to understand, appreciate and encourage the wildlife within the city.

Bristol Naturalists' Society Annual report 2012

Organisation.

At the AGM on 3 March 2012 The Secretary, Mr Robert Muston, Treasurer; Mr Stephen Fay; Membership Secretary, Mrs Hazel Nicholson; Bulletin Editor, Mr David Davies; Editor, Nature in Avon, Mr Richard Bland; Librarian, Mr Jim Webster; Archivist, Mr Roger Symes; were all re-elected as officers and Mr Mark Pajak, Mr Mike Johnson, Mr Peter Hilton, Ms Hannah Broughton and Mr Richard Ashley were chosen to represent the sections, with T Corner, and N Hudson, as ordinary members. The role of Website Manager remains vacant.

Grants.

£100: contribution towards the re-printing cost of the Downs Lichen Leaflet.

£5000 towards the publication costs of *Wildlife of the Bristol Region:3 "Dragonflies of the Bristol Region"*: this exceptional amount was approved as a special contribution during the Society's Anniversary Year. Recognition of this donation will be acknowledged on the front cover. (Publication: February-March 2013)

£150: to the Cam Valley Wildlife Group to fund the provision of 150 Barn Owl breeding boxes.

£450: application from Alex Rhodes, on behalf of the British Trust for Ornithology, for the purchase of mist nets.

£2040: was approved for the production of the Avon Bird Atlas.

Library Report.

We must thank all the library committee members for their help and support during another very productive year, but special recognition must be given to Cathy Barron who has now finished reorganising the lending library and the classification numbering of all the books. Heritage value books have been stored separately from the lending area and will be carefully assessed next year for future care and conservation.

Other members of the committee have been busy releasing space from the shelves by finding suitable new homes for journals of little or no interest to existing or future BNS members. A long run of journals of the Marine Biological Society Association was given to Bristol Museum and a few journals to other distant Natural History Societies replacing volumes missing from their own collections. Fourteen books were bought during the year covering diverse subjects from Micro-Moths to Mushrooms and Geomorphology to Freshwater Invertebrates. In addition many books were generously offered as gifts and accepted into the library collection.

A major reorganisation and clearance of redundant paperwork from the stock room was also carried out, allowing further storage space and recording the contents on the computer for efficient retrieval.
2013 is expected to be another busy year with the completion of the reorganisation, before moving on to the challenge of promoting the greater use of this valuable asset.

Archives
2012 was a fairly quiet year with archives because of significant changes which were being made to the Library stock and layout, and of personal circumstances. The Library computer is being used to record archive material and some further progress was made late in the year. An unruly accumulation of boxes of recently donated material, and of others "discovered" in the store room, is now under control with sorting and documentation becoming simpler during 2013. Further donations of material such as records of meetings and Committees, notebooks, collections, photographs, and mementoes, would be welcomed.

Society General talks
In January, Jessica Kandlebauer, a PhD student from Bristol University, gave a talk on the 1815 Tambora eruption which was one of the largest explosive eruptions in the last 200 years, and discussed whether our society faced similar consequences today if such an eruption were to happen again.
In February, Roger Symes gave a talk on Badgers and Bovine TB showing how the debate reveals a surprising mixture of elements of science, animal health, politics, animal welfare, opinions, conservation, official enquiries, prejudice, hatred, legislation, media, and children's stories.
At the Annual General Meeting in March, the outgoing President, Richard Bland, talked on the impact of weather on the plants of the Downs. This talk discussed the results of a weekly standard walk across Clifton Down during the past decade. The Bristol climate is almost a degree warmer than it was a century ago when White published his Flora and this survey should improve our understanding of the way our flora has changed in that time.
In October Michael Pocock described the history of the recent invasion of this country by the Horse Chestnut Leaf miner moth, examining how it has spread so fast, the impact on Chestnut trees, and the slow increase in parasites that may check its activities in time.
In November Jackie Garner, a wildlife artist, outlined the range of her work, and in particular her interest in the history of wildlife art, with some fascinating examples from Egypt where she has done a lot of work, and here enthusiasm for penguins.
In December Oliver Smart produced a series of stunning images of his recent visit to Alaska.

Mid-week walking Group

For the year starting January 2012, there has been one walk organised on the first Thursday of the month. This very healthy activity always includes one steep-ish gradient as exercise for cardiac muscles, when all the other muscles are warmed up, producing that pleasurable 'glow'. This is not to forget the sharing of wildlife expertise among fellow naturalists and enjoying the countryside. Each walk is serendipitous, such as walking in Cheddar Gorge and being amazed by the towering cliffs in January; or the jerky movements of the Nuthatch searching oak bark crevices in a crouching stance at Midford in February; the fog turned white by the distant sun as we looked at lichen-bright shrubs at Clevedon in March; the buzzard nest in a pine tree at eye-level as we walked on the Bristol-Bath cycle-track in April; readers of the Bulletin may remember our account of trying to get a meal at the Lock-Keeper, 'And, as the cock crew, those who stood before The Tavern shouted – 'Open then the door! You know how little while we have to stay, And, once departed, may return no more.'; flocks of both Swallows and Lapwings as we walked on the levels near Tickenham Court in May; seeing the Swifts in the lee of storm-tossed Sycamores swooping to catch aphids shaken from the twigs at Horton in June; meeting a BNS photographer in the Avon Gorge in July and being shown Bee Orchids and a Wasp Orchid; a superb avenue of ancient beech trees off Dolebury in August; a beautiful day by the river Boyd at Doynton in September; being shown how to recognise the Wheatear from its upright stance revealing an apricot area beneath the beak, during the Littleton-upon-Severn walk in October; a hidden brook near the top of Dundry and extensive views north, south, east and west in November; and mud, very steep slopes, fruits on the bushes and great Mendip views at Croscombe in December. Only in June did we get wet through and then had a good lunch at the Dog Inn, Old Sodbury, sitting by the fire grate but with imitation flames!

Photographic Exhibition

As part of our 150th Anniversary celebrations, a photographic exhibition was held on 14th April in the Bradbury Hall, Henleaze. In the first of his two appearances for the society, the event was opened at by the Right Honourable Lord Mayor of Bristol, Councillor Geoffrey Gollop. The bright modern hall housed a display taken from an entry of over 200 photographs submitted for exhibition by Society members and members of the public. A further display of photographs was provided by members of the North West Bristol Camera Club. Additionally, further digital images were projected on a screen at the back of the hall, giving visitors the opportunity to sit down and enjoy them. Local environmental groups also attended.

There were local nature reserves displayed, giving food for thought for future visits. The Bristol Environmental Records Centre also provided a display, illustrating its valuable work. In the adjoining café, a friendly crew served tea, coffee and homemade cakes throughout the day. The exhibition attracted an attendance of over 400 visitors, many of whom were members of the public.

None of this could have happened without the help of a number of, ever-willing volunteers notably: Tony Smith, with his perception and original ideas; Sheila Quin, who organized the catering and a team of helpers; and special mention to the indefatigable Sylvia Kelly for mounting and arranging the photographic displays.

Above all, the brains and driving force of the exhibition was Robert Muston. As the exhibition date drew near, he put in more hours than there seemed to be available, to make it all work. I am sure that all who attended will agree with me that it was a splendid effort. On behalf of the Society, thank you all.

150th Anniversary Dinner

On 8th May, the society held its 150th anniversary dinner at the Freemasons' Hall, Park Street, Bristol. This date and venue were chosen as it was in this building, on 8th May 1862, where the society was founded. The dinner was the brainchild of Roger Symes who also devised the finely produced menu booklet provided for all who attended. He and Ann Wookey between them proved yet again how well they merited their Honorary Memberships, by organising the whole event.

The dinner was attended by 80 guests, including The Right Honourable Lord and Lady Mayor of Bristol. The keynote speaker Nigel Marven (of TV fame), who was accompanied by his wife. Nigel Marven was also accompanied by a sturdy and almost immobile Australian companion, a Blue-tongued Skink, which proved an entertaining challenge to any photographer wanting to catch a shot of its main moving part – the blue tongue.

The BNS President, Roger Steer conducted us through the proceedings and introduced the three main speakers. We heard from the Lord Mayor of how the Society's activities benefit Bristol's community. Roger Symes gave a a short "eight-minute history of BNS" and Nigel Marven gave us on an account of his many travels and occasionally hair-raising experiences.

Thanks are due to Nicholas Wray, Director of the Bristol University Botanic Garden, who with his colleagues Peter & Anne Girling brought a display of exquisite botanical drawings, displayed in the entrance hall a small foretaste of the five day exhibition of prints which took place later in the month at the Botanic Gardens.

The Society's thanks are also due to Roger Symes who organised the whole occasion together with the help of Ann Wookey, Hazel Nicholson and Mandy Leivers. Between them they did so much to make our 150th Anniversary Dinner such a success.

The award of the H. H. Bloomer medal to Libby Houston

This year, the Society congratulates one of its own members on receiving the H. H. Bloomer medal by the Linnean Society awarded to *"an amateur naturalist who has made an important contribution to biological knowledge."* This prestigious award was made in recognition of her exceptional contribution to the knowledge of the Avon Gorge. Her early studies looked at Avon Gorge rarities such as Spiked Speedwell *(Veronica spicata)* and Bristol Rock-cress *(Arabis scabra)* and much of her recent work has been on the endemic Avon Gorge Whitebeams *(Sorbus sp)*. This outstanding achievement results from many years of study.

Reading Group

Biodiversity, genomes, the food chain, black holes, habitat, ecology, the environment, etc. Ideas may be devalued and many pronouncements are made by the media which are misinterpretations of important ideas. Members of the BNS (and others are invited) may read a particular (natural history) book over a three-month period coming together at least twice within that time to share thoughts, fostering understanding and developing criticism of ideas that are discussed within the scientific and philosophical atmosphere we breathe. The reading group members collectively discover books on shelves, on the internet, from reading the papers and getting into discussion with other people and our reading therefore reflects this broad perspective.

This year we have enjoyed reading *And the Earth Moved* by Amy Stewart, which delved into the lives of earthworms, their importance, as Darwin discovered, and the high levels of damage they do in the deep leaf-litter layer in North American forests, destroying a whole habitat and its component organisms. We then moved on to *Trilobite!* by Richard Fortey, all of us being delighted by the high literary merit of this monograph on a remarkably diverse group of crustacea known only from fossils.

Life on a Little-known Planet by Howard ensign Evans covers the world of insects in about a dozen chapters but is a book from the 1960s. Very enlightening (and therefore more or less up to date) for all of us on the insect orders it discusses but we were astonished at the author's dismissive attitude to Rachel Carson's *Silent Spring*, a book now universally regarded as the wake-up call for the environment movement. The final book this year is *The Driving Force*, written in the 1980s, by Michael Crawford and David Marsh, which argues that evolution is not governed by the caprices of chance but by underlying laws of chemistry mediated through different forms of life consuming particular foods, in particular predators gaining essential metabolites, rather than producing their own. We welcome new members and details of Reading Group appear regularly in the BNS Bulletin.

Publicity.
In January we joined forces with the Avon Gorge and Downs Wildlife Project to run a joint stall at Bristol Museum's Big Wildlife Fair. 206 people of all ages took part our *What am I?* wildlife quiz and visitors could also get a close-up view of aquatic wildife using a mini camera projected onto a laptop. We also took along our display, publications, new pull-up sign and re-designed membership leaflets. The Society's 150th Anniversary photography exhibition acted as a focal point for raising our profile during the year. In the run up to the event in April, posters were produced and articles written for local magazines. A press release was also issued which resulted in a couple of very nice articles in the Evening Post and on the This is Bristol webpage. The President also gave an interview on BBC Radio Bristol on the morning the exhibition opened. The Downs Lichen trail (produced as a collaboration between BNS member Sheila Quin and the Avon Gorge and Downs Wildlife Project, and part funded by the Society and the British Lichen Society), proved to be more popular than expected. A re-print of 2,000 copies was done in May.

In June, the Society attended the Bristol Festival of Nature (the UK's biggest celebration of the natural world which attracts more than 25,000 visitors). Posters advertising Society events were produced on a regular basis and displayed in libraries. The Society's new website was also well used. The Society was represented at the "Big Wildlife Fair" organised at the City Museum in June, providing a children's quiz and a stand providing views of pond life observed using a USB microscope connected to a computer. Also in June the Society was represented at the Abbots Leigh "Mini Bioblitz", and the "Urban Pollinators Evening" organised at the University Botanic Garden.

Sectional reports

Geology Report
The Geology Section AGM was held on 25 January when the following Officers were elected: - President - Roger Steer, Secretary - Richard Ashley and Field Secretary – Chris Townson. The AGM was followed by presentations on the Geology of Stockwood, Bristol by Richard Ashley and Geological Maps by Gordon Hobbs.

The following meetings took place during the year-
22 February: Lecture on "Understanding the Diversity and Evolution of Life through time" by Rachel Warnock, Bristol University.
21 March: Lecture on "Time travel in the Gravel and Jurassic delights of the Cotswold Water Park" by Dr Neville Hollingworth.
26 May: Field Meeting "Looking at Liassic Rocks in the vicinity of East Quantoxhead and Kilve" led by Richard Ashley.
30 June: Field Meeting "Stowey Quarry" led by Simon Carpenter.
18 August: Field Meeting "Beachley Point, Tutshill and Tidenham Chase" led by Dave Owen.
24 October: Lecture on "The Forgotten Engineer" by Trevor Thompson
28 November: Lecture on "The Lias and its Fossils" by Prof CRC Paul
In addition to the field meetings listed above some members also attended field meetings organised by Bath Geological Society. At a meeting held in August at Box between representatives of BNS Geology Section, West of England Geologists Association and Bath Geological Society it was agreed to organise a joint programme of field meetings for 2013.

The Section would like to record its thanks and appreciation to Bristol University's Department of Earth Sciences for allowing the use of the S H Reynolds Lecture Theatre for its winter meetings and other support

Mammals Group
2012 has been the first full year for the newly formed Mammal Group. We have had several field meetings including two dormouse monitoring surveys (during which dormice were seen on both occasions) and a badger watch (unfortunately the badgers were too stealthy for us but we were invited by the University of Bristol Grounds Maintenance team to try again next year). We have made some progress towards setting up a bat monitoring site. We have also organised several talks, including a bat talk by national expert Daniel Hargreaves and a hedgehog talk by ecologist and author Hugh Warwick. We have made some progress towards working collaboratively with the Bristol and Gloucester Mammal Group, and the hedgehog talk was an example of this collaboration.

Botany Report

Approximately 25 Field Meetings were arranged.

In the depths of winter over 20 members joined Sheila Quin to explore the recently established Lichen Trail on the Downs. A Bryophyte meeting followed in February led by our section President, Nick Hudson. An indoor meeting in March inspected the herbarium at the Museum which attracted much interest and was facilitated by the Collections Curator, Rhian Rowson.

At the first of his two meetings, the Society archivist and student of the history of Bristol Botany- Dr Clive Lovatt- led an urban walk following in the footsteps of James White (who produced his famous flora of Bristol in 1912). Later in the year the rather fitter members of the botanical section accompanied Clive on the classic White Walk from Pill to the Suspension Bridge.

A huge turn-out greeted Tony Titchen for his tree gazing trip around the lovely gardens at Goldney House in Spring with a second meeting at Canynge Square in Autumn again attracting a sizeable attendance. A limited number of spring flowers were in evidence for a Harbourside walk in early Spring and a joint meeting in late May with Somerset Rare Plants Group at Sand Point yielded spectacular records including *Poa bulbosa, Koeleria vallesiana* and *Erodium maritimum*. A joint meeting with Gloucestershire Rare Plants Group was organised to search for *Anacamptis morio* (on the threatened plant list) at a previously recorded site near Hawkesbury Upton. Although unsuccessful, a good range of other plants were found including *Hippocrepis comosa, Orchis mascula* and *Paris quadrifolia*. Nick Hudson led a walk on Rodway Common. A number of members of Bristol Naturalists were involved in the Botanic Garden Local Rare Plant Group special event. A meeting on Dundry Hill was cancelled because of the on-going poor weather conditions. In June Tony Smith led a beginners meeting for identification of wildflowers and grasses of the Durdham Down to which members of Friends of the Downs were invited. David Hill led a trip to the botanically rich Wavering Down in June. A joint meeting with Gloucestershire Naturalist' Society at Painswick on a rare beautifully sunny day was led by Ellie Phillips attracting the crowds and revealing good colonies of Musk Orchids amongst other delights. A trip to the Royal Portbury Dock failed to materialise but the warden of nearby Portbury Wharf, Bernie Darcy, permitted access to unrecorded areas of this very new reserve and yielded some interesting new records including *Sanguisorba officinalis* (the only site in VC6).

At a late August evening meeting, Libby Houston showed that the Great Quarry in the Gorge possessed a quite excellent flora. An impromptu meeting was held at St Catherine's Valley led by Ellie. Mark and Clare Kitchen led a meeting at Shirehampton in August walking along the salt marsh and river cliffs where a second location for *Sorbus domestica* was found along the Avon. At the Portbury Wharf and St Catherine's Valley meetings sizeable lists were also made of insects seen and these with some additional records from other meetings contributed to a 'naturalists' approach.

The speakers programme for the year 2012 included a talk by Sharon Pilkington, the Wiltshire Vice County Recorder, about the special plants of Salisbury Plain. Dr Camilla Lambrick talked about plants of the drawdown zone. A workshop on Conifers led by Clare and Mark Kitchen was a hands-on experience using material blown down by winter storms and a follow up meeting is proposed for 2013. This Autumn Clive Lovatt gave a unique presentation about an era of early Bristol botany (1835 to 1869) and following this Dr David Hill will talk about Natural Dyes from Plants.

Invertebrate Report

Mark Pajak was elected President and Tony Smith was re-elected Honorary Secretary at the AGM held at the Schools Room, Bristol City Museum and Art Gallery.

The following indoor meetings were held:
January 15 Section AGM and Presidential Address by Ray Barnett
May 3. Why Everybody Should Hug an Octopus by Matt Wale.
Sept 7 The Behaviour and Ecology of British Ticks by Professor Richard Wall.
October 23 British Slugs: Can we forgive them? by Dr. Ben Rowson.
and the following field meetings:
April 28 Colliter's Brook, Ashton Vale
May 13 Crow Lane
June 9 Grassy slopes, Westbury-on-Trym
July 8 Stanton Wick
July 22 Velvet Bottom
August 5 Create Centre
August 28 Hanging Hill Wood
September 22 Abbots Pool Nature Reserve.
October 7 Avon Gorge

Online Activity: a new blog entitled 'Bristol Loves Bugs' was set up to publicise the section's activities to a wider audience and increase the traffic of visitors through to the main BNS website. Visitor statistics show 887 unique visitors to the site.

Ornithology Report.
Tthe Section held thirteen field meetings. There have an impressive number of interesting bird sightings. Highlights have been a Lesser Scaup at WWT Slimbridge; Ring Ouzel at Brean Down; Marsh Harrier, Hen Harrier, Bittern, Jack Snipe, Great White Egret and Cranes on the Somerset Levels; Nightingales at Highnam Woods; Nightjars and roding Woodcocks in the Forest of Dean; A singing Lesser Whitethroat at Stockwood Open Space. A walk over the Bath Skyline produced forty-three species in largely woodland, meadow and urban habitat. The Lecture Meetings produced a wide variety of interesting and well presented talks. Richard Bland presented the results of the surveys compiled for the Bird Atlas for the Bristol region and highlighted some dramatic changes and interesting conclusions. Roger Lucken gave an account of the Crane Project on the Somerset Levels. Philip Mugridge showed some brilliant images of birds and other wildlife on Iceland and John Sparks gave a beautifully illustrated account of the birds and other wildlife of Svalbard and the potential problems affecting that area due to climate change. Members of the Section took part in the BTO Breeding Bird Survey and Birds in Garden Survey and also the National Nightingale survey.

Relations with other organisations.
The Society sends its records to the Bristol Environmental Records Centre, and supports the Avon and Bristol Biodiversity Action Plans. It supports the Avon Wildlife Trust. It is involved with the city Environmental Officer and the monitoring of the Avonmouth Wind Turbines, and carries out surveys for The British Trust for Ornithology, and the RSPB.

Thanks.
The Society is grateful for the help and support it received from the Earth Sciences Department, University of Bristol, and Mrs Julie Finch, Director of Museums, Galleries and Archives, Bristol City Council, for continued support of the Society Library located within the City Museum & Art Gallery. It is also grateful to all those members of the society who gave so willingly of their time and energy in the course of the year to support the aims of the Society.

Bristol Naturalists' Society

Statement of financial activities for the year ending 31 December 2012

		2012	2011
INCOME (Incoming resources)			
Membership Subscriptions		7584.00	6556.25
Gift Aid		1387.07	1073.85
Bequests & Donations		470.00	433.50
Trading		58.52	279.10
Interest Received		381.07	194.69
Miscellaneous		100.00	50.00
Total		**9,980.66**	**8,587.39**
EXPENDITURE			
(A) Direct Charitable			
Meetings (Room Hire & Speaker Costs)		1,612.81	1,245.78
Books & Periodicals (Library)		712.14	626.31
Nature in Avon (Proceedings)		1,540.00	1,531.00
Avon Bird Report		1,536.00	1,470.00
Bulletin Production		1,323.22	933.40
Publications Distribution Costs		1,535.21	1,453.95
Subscriptions to other Organisations		63.00	60.00
150th Anniversary Events **(Note 2)**		1,492.72	0.00
Publicity		756.42	1,415.80
Grants Awarded		2,740.00	182.70
Total		**13,311.52**	**8,918.94**

(B). Administration			
Print & Stationery		80.66	119.03
Postage & telephone		111.49	113.73
Council Meetings (Room Hire)		240.00	135.00
Insurance		157.92	133.02
Miscellaneous		127.79	457.43
Total		**717.86**	**958.21**
Operating Surplus (Deficit)		**-4,048.72**	**-1,289.76**

BALANCE SHEET AS AT 31 DECEMBER 2012				
	Notes	**2012**		**2011**
ASSETS				
Current Assets				
Prepayments	**1**	417.15		977.76
Bank (Lloyds)	**3**	1,146.95		847.95
CAF Gold	**4**	5,547.63		9,530.04
CAF Platinum	**5**	30,435.48		30,072.00
		37,547.21		**41,427.75**

LIABILITIES				
Creditors				
Subscriptions Received in Advance		450.00		521.50
Accruas		239.68		
		689.68		**521.50**
Total Assets less Total Liabilities		**36,857.53**		**40,906.25**

CAPITAL				
General Fund 31/12/2011		40,906.25		38,406.25
Net deficit 2012		4,048.72		
General Fund 31/12/2012	**6**	36,857.53		
150th Anniversary Fund		0.00		2,500.00
		36,857.53		**40,906.25**

			NOTES
1	**Prepayments**		
	Meeting Rooms	224.00	
	Insurance	66.15	
	Periodicals	97.00	
	Publicity	30.00	
			417.15
2	**150th Anniversary Events**		
	Meal (Expenditure less receipts)	511.55	
	Photographic Exhibition	814.17	
	Anniversary Bulletin	167.00	
			1,492.72
3	**Lloyds Bank**		
	Statement # 9	1,412.00	
	Unpaid cheques	265.05	**1,146.95**
4	**CAF Gold**		
	Opening Balance	7,030.04	
	Interest Received	17.59	
	Transfer to Lloyds	-4,000.00	
	Transsfer 150th Anniv. Fund	2,500.00	
	Closing Balance		**5,547.63**

5	**CAF Platinum**		
	Opening Balance	30,072.00	
	Interest Received	363.48	
	Closing Balance		**30,435.48**
6	**General Fund**		
	Bank (Lloyds)	1,146.95	
	CAF Gold	5,547.63	
	CAF Platinum	30,435.48	
	Prepayments	417.15	
	Creditors	-450.00	
	Accrual	-239.68	**36,857.53**

Comment on the picture section

Pictures 1 to 3 are illustrations from the account of Charles Richardson's work. No 1 shows the log slide bridge referred to on page 9, built over the Stroud valley railway to enable the owner of the woodland to move his timber from the wood.
No 2 is the tunnel of the Bristol Harbour railway under St Mary Redcliffe church. Note that the system was designed for broad gauge track.
No 3 is the entrance to the Severn Tunnel from the Bristol side. The difference in levels is the result of the decisions taken after the catastrophic flood.
No 4 is a micro photograph of the midge eggs in Sneyd Reserve Lake, page 92
No 5 Is the hatched midge larvae, with named parts.
No 6 is the Volvox which the larvae feed on.
No 7. The extreme rainfall in 2012 led to a river forming down the Gully on the Downs, and on Sept 24th 2012 72m m fell, creating a flood that dug the path out by about 30cm.
No 8 The Red Oak on the triangle of Downs outside the Lord Mayor's house.
No 9 Pampas grass , a rare garden escape, in the Gully.
No 10 Twiggy Mullein has several colour forms, and flowered in 2013 on St Vincent's Rocks.
No 11 A fine picture of Ragged Robin by Robert Muston.
No 12 and 13 Tony Cottrell's insects pictures are magnificent.
No 14. The exceptional conditions in 2012 enables a very rare fungus that affects Sycamore leaves to become very widespread indeed. The normal Tar Spot fungus is also present.
No 15 The Japanese Maples at Westonbirt are justifiably famous.

Instructions for authors

The editor welcomes original papers or short notes on the natural history of the greater Bristol region for consideration for publication in Nature in Avon. All papers for consideration should reach the editor by the end of February. All Society Reports and Biota should reach the editor by the end of February in the year of publication.

Whenever possible, text should be submitted electronically in Word. The data for graphs should be sent in Excel, separately from the graph, as graphs have to be recreated to fit the page size of the journal. Any other illustrations should be submitted electronically.

The Editor welcomes digital photos of any natural history subject taken in the region, whether relevant to an article or not. They should be of the largest pixel size possible. However as the number of colour illustrations is strictly limited he cannot promise to print any

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Rerum cognoscere causas - Virgil

Cover. Huntingdon Elm on the Downs, Winter Solstice dawn.

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